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SWINE ERYSIPELAS

THERE appears in this issue of THE JOURNAL an important paper by Dr. Creech entitled "The Bacillus of Swine Erysipelas Isolated from Urticarial Lesions of Swine in the United States."

The opinion has prevailed generally that we do not have swine erysipelas in this country. However, the Federal veterinary inspectors assigned to post-mortem work at meat-packing establishments have frequently encountered deep red blotches on the skin of swine, rhomboidal in shape and varying in size, which they have reported as "diamond skin disease." Occasionally extensive red areas resembling "frost bite" lesions have been observed, but in only one case has a veterinarian reported lesions of the viscera which might be regarded as suspicious of acute swine erysipelas.

It has been proved conclusively that urticaria, or "diamond skin disease," in Europe is caused by the *B. erysipelatis suis.* Since Dr. Creech has succeeded in finding and identifying this organism in skin lesions obtained from our abattoirs, the subject of "diamond skin disease," which is regarded as a chronic form of the malady, may be of more scientific as well as economic importance than we have hitherto believed. It seems quite plausible that this organism, which also exists as a saprophyte,

might under favorable conditions acquire sufficient virulence in the United States to produce the acute form of the disease. It has even been suggested that the *B. erysipelatis suis* might be associated in some way with some of the phenomena observed in what are termed "breaks" following the immunization of swine against cholera.

It is noted that some of the material used in the investigations of "diamond skin disease" came from a hog which originated in Texas. There appears on another page of THE JOURNAL an abstract of a paper by E. Lopez Vallejo on the subject, "Mexican Red Fever of Swine and Its Preventive Vaccination." It is inferred from this paper that swine erysipelas exists to a considerable extent in Mexico, and in this connection the thought naturally arises as to whether there might not be some relation between the existence of the disease in Mexico and the recent discoveries in the United States. It appears that the regulations of the Department of Agriculture governing the importation of animals from Mexico are sufficiently comprehensive in their scope to protect our swine industry against invasions of erysipelas and other contagious diseases which otherwise might reach us through the regular channels of commerce. Up to the present time animals of the porcine species have rarely been imported from Mexico, except for slaughter and a few peccaries for exhibition or experimental purposes. The established avenues of commerce between the United States and Mexico are well guarded, but even a greater source of danger seems to be the swine that are allowed to roam at large along the international border. While the Rio Grande forms a portion of the boundary line, it is not believed that this river constitutes a sufficient barrier during the dry season to prevent swine from passing at will from one country to the other. In view of the results of this recent investigation, veterinary practitioners should be on the lookout for clinical cases which might be regarded as suspicious of swine erysipelas.

THE DENVER MEETING

EVERY veterinarian who can possibly do so should attend the A. V. M. A. meeting in Denver, September 5th to 9th inclusive. Summer excursion rates of one and one-third fares will be in effect good until October 1. In purchasing your ticket you can

get your ticket to Denver or to Colorado Springs via Denver, in case you wish to see the sights at Colorado Springs. The summer excursion tickets are also good, going over one road and returning by another.

The Burlington Route has been selected as the official route from Chicago to Denver. This will enable those from Chicago and eastern points to travel together to Denver. Leaving Chicago Saturday night, September 3 at 11 p. m., puts one in Denver on Monday, September 5 at 7.30 in the morning. You can return over another route any time until October 1. Full particulars will be given later and a program of the meeting will be mailed to every member about August 1.

The Denver meeting will give you an opportunity to attend the A. V. M. A. meeting for which an excellent program is being provided, and also to enjoy an unusual fine outing. Many veterinarians are planning to drive to Denver and arrangements are being made so that those going from Kansas City and vicinity can drive through in a bunch and have a good time together. The roads through the West are usually in excellent condition at this season of the year. There are free camping sites in Denver and other western cities. Those who are planning automobile parties to Denver should write to THE JOURNAL, giving date and place of starting and the itinerary so that others may join them on the route.

The entertainment feature for the Denver meeting has been particularly stressed by the committee in charge because it is realized that people come to Colorado to have a good time as well as for serious considerations. It has, therefore, been arranged to take the whole organization for a one day's trip through the mountains back of Denver, past Buffalo Bill's grave, over Lookout Mountain and down Bear Creek Canyon. Here the light air, mountain scenery and substantial lunch to be furnished at the end of the drive will be expected to put new life into all visitors from the humid East. If anybody comes without having the time of his life it will not be because the committee has not made sufficiently extensive plans. For the really serious side of the meeting, the Denver City Auditorium has been engaged, which building has sufficient room for all purposes, since it covers half a block and comfortably housed the Democratic convention of 1904.

The Albany Hotel has been selected as headquarters, where reservations can be made at any time. Plan now to take the summer vacation by attending this meeting and if within reasonable distance, motoring through Colorado will be found very exhilarating. N. S. M.

PROMPT ACTION IN FIGHTING HOG CHOLERA

WHY WILL farmers delay so long in calling assistance when disease appears in their swine herds? Unless early action is taken to diagnose these cases and apply proper treatment, it stands to reason that losses are inevitable. The chances are many that the trouble is cholera and under such circumstances delay is dangerous, for when that disease has spread and progressed in the herd destruction of a large number of animals may be expected.

Early attention in an outbreak of hog cholera is essential for the successful treatment of the herd. It has been told repeatedly that antihog-cholera serum is not a cure; its use is primarily intended as a preventive agent against cholera and as such it is universally recognized as the only reliable treatment. While the serum seemingly has had some favorable effect when administered to sick hogs in the very early stage of cholera, swine owners should not depend upon the product to save any number of animals after they have developed visible symptoms of hog cholera.

In Farmers' Bulletin 834 (Revised) attention is called to the fact that the serum is most efficacious when administered as a preventive. On page 16 of the bulletin appears the following: "While the serum is regarded as most efficacious when administered as a preventive, it seems to have some curative value, provided it is administered when hogs are in the very early stage of the disease. But very little benefit can be expected from the treatment of hogs that are visibly sick." Again, on page 19: "Serum should be used with the understanding that it is a preventive rather than a curative agent." And, finally, on page 22: "It has been stated that serum alone has some value in treating sick hogs. This is true within a certain limitation. Ordinarily it is efficacious only in the very early stage of the disease, before the hogs show visible signs of sickness."

In a bulletin issued recently by Dr. R. C. Reed, Chief, Animal Industry, Maryland State Board of Agriculture, appears the following: "An analysis of the data obtained from sick herds, vaccinated in Maryland during 1919, shows that over one-fifth of the swine had died or were too sick to treat before the herds were immunized." Information from other States where control work is being conducted points to a similar lack of prompt attention in reporting outbreaks of hog cholera.

Much of the criticism and unfavorable comment against antihog-cholera serum are due to the fact that farmers delay the use of the product for too long a period after cholera has reached the herd. When many of the animals show symptoms of the disease and the temperature reveals a high fever, it is not reasonable to suppose that serum will do much towards limiting losses. Therefore, the warning is again given to treat the animals at the very first sign of cholera in the herd. Or better still, if there are reasons to suspect that the hogs have been or are exposed to infection, they should be immunized before they have fallen victims. In sections where there are no known outbreaks of cholera there does not seem to be any need for wholesale treatment, but when the disease makes its appearance in the vicinity no time should be lost in having all susceptible hogs immunized against the disease.

Reports indicate that farmers and swine owners are remiss in guarding against the introduction of infection and are generally inclined to expect too much of antihog-cholera serum as a curative agent.

FRENCH AND GERMAN SCIENTISTS

FRENCH scientists seem disposed to continue in their insistence that, as a condition to their resumption of relations with Germans in international scientific gatherings, the German scientists shall publicly repudiate the attitude assumed in the famous manifesto issued in 1914 by representatives of German science and art in justification of Germany's course in the war. The following resolution was recently adopted by the French Committee of the Second International Congress of Comparative Pathology which is scheduled to be held in Rome this year:

"*Whereas,* French scientists will not be able to accept the invitation to participate in a congress which German scientists

have been invited to attend, until the latter shall have proclaimed, by a public act, that they repudiate all connection with the government and the military leaders of Germany in 1914 as regards the antisocial acts committed by these during the war; therefore, be it unanimously

"*Resolved*, That French scientists are under obligations to refrain from attending the Second International Congress of Comparative Pathology if the subjects of the Central Powers are invited to be present, which decision is in conformity with that arrived at in London in October, 1918, on the initiative of the Royal Society, and at Brussels in July, 1919, where a ratification of the decision by the delegates of the academies of the various Allied Nations was recorded."

SHORTAGE OF HORSES

Aroused by advance reports of the 1920 census that the supply of horses in the United States had decreased more than two million in the last ten years, the Horse Association of America is planning to launch an intensive drive to encourage horse breeding as a factor in the country's economic development. The census reports show there are now approximately 25,300,000 horses and mules in the country. The association has completed a survey of horse power on the farm, which shows that the cost of plowing with horses or mules is cheaper than with motorized plows. The association will appeal to country bankers throughout the United States to aid the farmer in rehabilitating the horse market.

The American Remount Association, which is interested particularly in the development of horses suitable for Army purposes, also is planning a drive to interest farmers in the breeding of horses of this type.

CIVIL SERVICE EXAMINATION

The United States Civil Service Commission announces an open competitive examination on May 11, 1921, to fill vacancies as they may occur in the Bureau of Animal Industry. Application forms can be had by applying to the Civil Service Commission, Washington, D. C.

THE BACILLUS OF SWINE ERYSIPELAS ISOLATED FROM URTICARIAL LESIONS OF SWINE IN THE UNITED STATES

By G. T. CREECH

Pathological Division, Bureau of Animal Industry, United States Department of Agriculture

SINCE the discovery in 1885 of the *Bacillus erysipelatis suis* by Löffler (1), who, together with Schutz, differentiated swine erysipelas from hog cholera, considerable investigational work has been done with regard to this disease of swine by Bang, Jensen, Preisz, Lorenz, Voges and other well-known European investigators.

Swine erysipelas is known to be widespread throughout Continental Europe, yet literature fails to record a single instance of an outbreak of the disease in the United States, and it seems to be the consensus of opinion of practically all authorities on the subject that swine erysipelas does not exist in this country. Hutyra and Marek (2) make the statement that erysipelas of swine "occurs in the benign form in the United States of North America." The authors quoted no doubt referred to the so-called "diamond skin disease" of swine.

Urticaria, or "diamond skin disease" of swine, which is not infrequently encountered by Government inspectors at the various slaughtering establishments in the United States, has long been known to exist in this country. In Europe the etiology of this condition in swine is accepted by different authorities as being the same as the organism causing the acute form of swine erysipelas, *i. e., B. erysipelatis suis.* In other words, "diamond skin disease" is simply considered as being a chronic form of the disease. In the United States such skin affections have heretofore been considered of rather minor importance.

There appears to be no authentic case on record in which *B. erysipelatis suis* was isolated from swine in the United States, wherein the organism was definitely identified as such. There are a few instances recorded where the closely related organism of mouse septicemia, *B. murisepticus,* first described by Koch (3), was isolated from the tissues of swine. Smith (4) in 1885 isolated an organism from the spleen of a pig which he

subsequently identified as *B. murisepticus*. Three years later Moore (5) obtained a similar organism also from the spleen of a hog. In 1894 Smith (6) again isolated a small rod from the lymph node of a hog which was identified as the mouse septicemia organism. More recently Tenbroeck (7) obtained an organism from the tonsils of swine in five different cases which were also identified by him as *B. murisepticus*.

That no considerable effort has been made to determine the etiology of urticaria in swine in the United States would seem to be indicated by the fact that the writer experienced little difficulty in isolating the organisms described herein from such lesions.

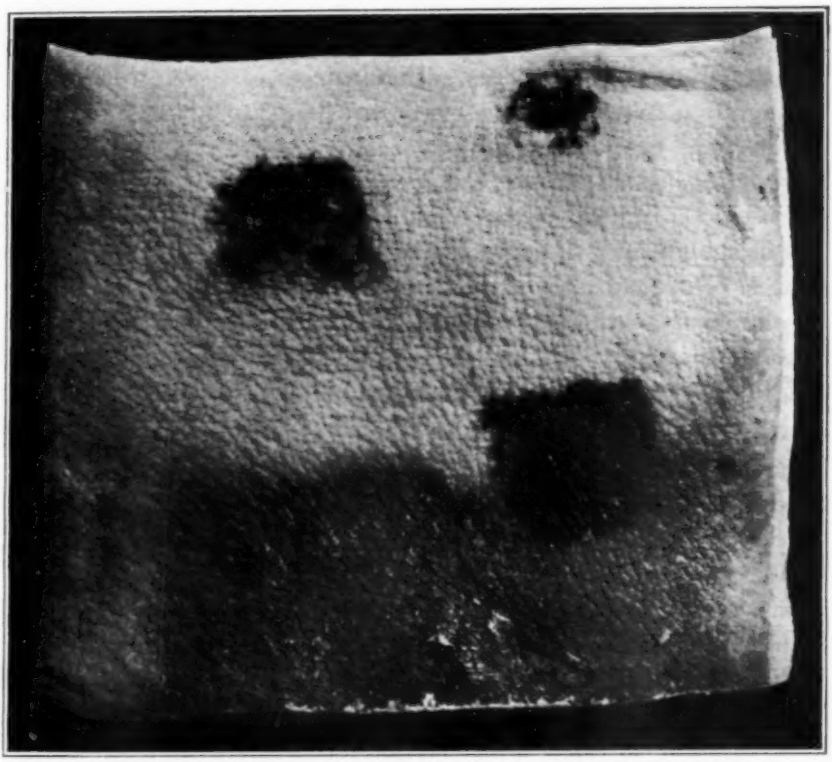
During the early part of 1920 the attention of the writer was directed particularly to this urticarial condition of swine by the receipt of specimens showing an unusually well-advanced case of such skin lesions which were submitted to the laboratory of the Pathological Division, for diagnosis, by Dr. H. K. Walter, of the meat inspection service of this Bureau. The studies and observations made relative to this particular case led to a further study of a number of somewhat similar cases which were received at the laboratory on subsequent dates. In this paper it is the intention to outline rather briefly the results of work done and experiments carried out with regard to the organisms isolated in five of the cases which came under our observation showing characteristics typical of *B. erysipelatis suis*. Certain details of the work done, especially in connection with the various inoculation experiments, etc., will be largely omitted, and only a general summary of the results will be given here.

LESIONS

In the first case examined the tissues submitted were from an animal which exhibited particularly well-marked inflammatory lesions of the skin and subcutaneous tissues. There was a highly reddened condition of the skin extending over a large portion of the surface of the body. In addition to the extreme red coloration there was also in this case a necrosis and sloughing of the skin in certain areas. In sectioning those areas most markedly affected it was noted that this deeply reddened or inflammatory condition extended beyond the skin proper to a depth of from one-fourth to one-half inch. Besides the skin specimens from

this particular animal, both kidneys and several of the body lymph nodes were also received for examination. The lymph nodes appeared to be somewhat congested, but there were no perceptible pathological changes in the kidneys.

The skin lesions in the other four specimens, from which the organisms described were isolated, varied somewhat in the different animals, from small reddened areas on the skin surface to the well-defined, slightly elevated, rhomboidal figures characteristic of "diamond skin disease." (See illustration.)



Specimen of Hog Skin Showing Diamond-Shaped Lesions from which Strain CH-2 of Organism was Isolated.

HISTORY

In only one case was the origin of the hog definitely known. This animal, which exhibited the more marked lesions, was shipped east from the State of Texas just prior to being slaughtered. Three of the hogs were slaughtered at Chicago and probably originated in the Middle West. The fifth animal was slaughtered near Washington, D. C., and was probably raised

in the East. From this it will be seen that some of the animals came from rather widely separated sections of the country.

BACTERIOLOGICAL STUDIES

Isolation of Cultures

Realizing that contaminating microörganisms penetrate to a certain depth from the surface of the skin, and in order to avoid them, a method was adopted of making cultural inoculations from the reverse side of the skin, *i. e.*, from the deeper subcutaneous tissue. This was accomplished by the removal of small cubes of the affected subcutaneous tissue, especially in the more marked inflammatory areas. These pieces of tissue were placed in bouillon tubes and on serum-agar slants. Cultures were also made from the kidneys and the lymph nodes.

The inoculated culture tubes were incubated at a temperature of 37.5° C. After 48 hours small colonies were observed on the agar slants, and there was a slight cloudiness of the bouillon tubes. Pure cultures of what proved to be a small bacillus were obtained from the several skin specimens and also from one of the lymph nodes. Failure was experienced in obtaining growths of the organism in culture media inoculated from the kidneys. The strain of the organism isolated from the tissues in this case was designated as BH-1.

The same technique was employed in obtaining cultures in the other four cases, in which the organism was isolated, and with equally good results. These strains of the organism were designated as BH-2, CH-1, CH-2 and CH-3.

Culturally and otherwise, the five strains of the organism isolated appeared to be practically identical in their several characteristics.

Morphology and Staining

The organism is a very slender, straight or slightly curved rod from 1 to 2 microns long. It is non-motile, non-spore-bearing and Gram-positive. In smear preparations the organism is seen to occur singly, in pairs, and occasionally in short chains or filaments somewhat wavy in outline.

Cultural Characteristics

Cultures were incubated aerobically and anaerobically, and either of the conditions appeared to be favorable for the growth

of the organism. Growths were also obtained at room temperature.

Agar.—On agar slants small round dewdrop-like colonies are formed which have a tendency to remain discrete even in the older cultures. Growth on agar is rather scant.

Solidified Blood Serum.—A very slight growth is obtained on serum, which is not liquified by the organism.

Bouillon.—Bouillon is rendered slightly cloudy in 24 to 48 hours. After several days a white or grayish sediment is formed at the bottom of the tube.

Gelatin.—This medium is not liquefied, and in stabs there are seen, after 4 or 5 days, lines radiating from the stab toward the periphery, giving the culture the rather unusual "test-tube brush" appearance which has frequently been referred to as a cultural characteristic of *B. erysipelatis suis.*

Potato.—There was no apparent growth on potato under aerobic conditions.

Milk.—There was no perceptible change in this medium after several weeks.

Indol.—All tests for indol were negative.

Carbohydrates.—There was no gas production in any of the various sugars listed. By referring to Table 1 it will be seen that there was acid production in only three of the sugars, while the remaining ten gave uniform negative results. The Andrade indicator was used as a means of determining the acid production in the sugars tested.

In making the sugar tests for fermentation and acid production, organism J-80[1], which is a known strain of *B. erysipelatis suis,* was carried through these tests in a manner identical with the other oranisms being tested, for comparative purposes. (See Table 1.)

EXPERIMENTAL ANIMAL INOCULATIONS

All of the strains isolated proved to be pathogenic for rabbits, white mice and pigeons when those subjects were inoculated with small quantities of 24-hour bouillon cultures. Guinea-pigs were also inoculated in all cases, receiving the same amounts of the cultures as the rabbits, but were apparently unaffected by the injections. All guinea-pigs inoculated were still apparently

[1] European cultures of *B. erysipelatis suis* were obtained from Prof. Jensen of Copenhagen, who kindly furnished us with four strains of this organism, which were desired for comparative purposes.

Table 1.—Cultural Tests

Organism	Dextrose	Lactose	Levulose	Carbohydrate						Raffinose	Saccharose	Salicin	Xylose
				Arabinose	Dulcite	Galactose	Inulin	Maltose	Mannite				
BH-1	+	+	+	−	−	−	−	−	−	−	−	−	−
BH-2	+	+	+	−	−	−	−	−	−	−	−	−	−
CH-1	+	+	+	−	−	−	−	−	−	−	−	−	−
CH-2	+	+	+	−	−	−	−	−	−	−	−	−	−
CH-3	+	+	+	−	−	−	−	−	−	−	−	−	−
J-80	+	+	+	−	−	−	−	−	−	−	−	−	−

+ = Acid production.
− = No acid production.

healthy a number of weeks after the inoculations. It was found that 0.5 c.c. or less of bouillon cultures of the different strains was sufficient to produce death in rabbits, and 0.1 c.c. proved fatal to pigeons and white mice. Death of the rabbits, mice and pigeons usually occurred between the third and fifth day after inoculation. The appearance of the lesions of the dead animals and pigeons was that of a septicemia. In many of the pigeons inoculated accumulations of fluid in the pericardium were observed on portmortem.

In most of the dead animals the organisms were found in the blood in rather large numbers. They were also found in excessive numbers in the pericardial exudate and in the various organs of the dead animals and pigeons.

Swine Inoculations.—Pigs from 6 to 8 months of age were selected for inoculations with the different strains of the organism. These inoculations were made at different times following the isolation of the organism in the different cases.

Three of the pigs were inoculated intravenously with 3, 4 and 6 c.c. respectively, of bouillon cultures of different strains of the organism. Two pigs received subcutaneously 4 and 8 c.c., respectively, of bouillon cultures, while a sixth pig was fed 10 c.c. of a culture of one of the strains. These pigs were kept under observation, and temperatures taken, for at least ten days. None of the animals appeared to show any ill effects as a result of the inoculations or feeding. In one or two instances the animals exhibited a slight rise of temperature, but this was not thought to be of any particular significance in the absence of

any other symptoms indicative of an infection with the organism. The results of these experiments were considered negative.

An attempt was made to increase the virulence of the organisms by passing one of the cultures successively through a number of pigeons. Final inoculations of six pigeons were made. In this experiment a quantity of pericardial exudate, about 4 c.c., was collected from the six pigeons, which were dead on the same date, and given to a pig intravenously, the idea being to avoid transferring the organism to artificial medium. While the virulence of the organisms was considerably increased for pigeons, the organisms did not prove to be pathogenic for the pig, as the results of the inoculation were negative.

SEROLOGICAL TESTS

A comparative study of these organisms was also undertaken by means of the complement-fixation test, with a view of determining the relationship, from a serological standpoint, between the organisms isolated from the skin lesions and the strains of *B. erysipelatis suis* received from Prof. Jensen.

In the first tests made, as indicated in Tables 2, 3 and 4, the immune or positive serum used was prepared by injecting a hog, No. 3318, intravenously with increasingly large quantities up to 15 c.c. of bouillon cultures of strain BH-1, the first organism isolated. The injections were made at intervals of 7 to 10 days. Antigen titrations were made against the serum obtained from hog 3318, using bouillon cultures of the organisms isolated by us as antigens. Negative serum used in tests was obtained from a normal hog. The serums were inactivated at 58° C. for 30 minutes. The hemolytic system employed in these tests consisted of a 3 per cent suspension of sheep red cells, 2½ units of hemolytic amboceptor and 1½ units of complement, the latter being titrated against the amboceptor and sheep cells. Proper controls were used on the positive and negative serums, antigens and the hemolytic system.

All of the strains of the organisms isolated from the skin lesions showed distinct antigenic value. A typical reaction showing the range may be seen in Table 2.

Bouillon cultures of the strains of *B. erysipelatis suis* from Prof. Jensen were then used as antigens and titrated in the same manner against the positive serum from hog No. 3318. In these

Table 2.—Serological Test Showing Typical Reaction

Antigen[1]	0.05 c.c.	0.1 c.c.	0.2 c.c.	0.3 c.c.	0.4 c.c.	0.5 c.c.
Positive serum[2]	−	+	+++	++++	++++	++++
Negative serum[3]	−	−	−	−	−	−

Antigen[1]	0.6 c.c.	0.8 c.c.	1 c.c.	1.5 c.c.	2 c.c.
Positive serum[2]	++++	++++	++++	++++	++++
Negative serum[3]	−	+	++++	++++	++++

[1]Bouillon culture of strain BH-2 isolated from skin lesions.
[2]Serum obtained from hog No. 3318, which had received six injections of cultures of BH-1.
[3]Normal hog serum.
− = Complete hemolysis.
+ = 25 per cent inhibition of hemolysis.
+++ = 75 per cent inhibition of hemolysis.
++++ = Complete inhibition of hemolysis.

tests it was noted that the Jensen cultures had an antigenic value equal to that possessed by our own cultures when tested against the positive serum prepared by us. Examples of typical reactions of the two different organisms and the close similarity of the range obtained in the tests will be seen in Tables 3 and 4.

Table 3.—Serological Test for Comparison with Jensen Culture (Table 4).

Antigen[1]	0.05 c.c.	0.1 c.c.	0.2 c.c.	0.3 c.c.	0.4 c.c.	0.5 c.c.
Positive serum[2]	−	+	++	+++	++++	++++
Negative serum[3]	−	−	−	−	−	−

Antigen[1]	0.6 c.c.	0.8 c.c.	1 c.c.	1.5 c.c.	2 c.c.
Positive serum[2]	++++	++++	++++	++++	++++
Negative serum[3]	−	−	+	++	++

[1]Bouillon cultures of strain BH-2 isolated from skin lesions.
[2]Serum from hog No. 3318 which had received six injections of cultures of BH-1.
[3]Normal hog serum.
− = Complete hemolysis.
+ = 25 per cent inhibition of hemolysis.
++ = 50 per cent inhibition of hemolysis.
+++ = 75 per cent inhibition of hemolysis.
++++ = Complete inhibition of hemolysis.

In the final tests made, bouillon cultures of the organisms isolated by us, and also of the Jensen cultures of *B. erysipelatis suis,* were used as antigens and titrated against an immune or "rotlauf" serum prepared in Germany by the Sächsisches Serumwork, Dresden. In these tests it was observed that there was a marked similarity in the behavior of our organisms and the Jensen cultures when titrated against the rotlauf serum produced in Germany. By referring to Tables 5 and 6 it will be seen that the titration results are practically identical in character.

Table 4.—Serological Test with Jensen Culture.

Antigen[1]	0.05 c.c.	0.1 c.c.	0.2 c.c.	0.3 c.c.	0.4 c.c.	0.5 c.c.
Positive serum[2]	−	−	+	++	+++	++++
Negative serum[3]	−	−	−	−	−	−

Antigen[1]	0.6 c.c.	0.8 c.c.	1 c.c.	1.5 c.c.	2 c.c.
Positive serum[2]	++++	++++	++++	++++	++++
Negative serum[3]	−	−	+	++	++

[1]Bouillon culture of strain J-80 of *B. erysiyelatis suis* obtained from Prof. Jensen.
[2]Serum of hog No. 3318 which had received six injections of culture of BH-1.
[3]Normal hog serum.
− = Complete hemolysis.
+ = 25 per cent inhibition of hemolysis.
++ = 50 per cent inhibition of hemolysis.
+++ = 75 per cent inhibition of hemolysis.
++++ = Complete inhibition of hemolysis.

Table 5.—Serological Test with "Rotlauf" Serum

Antigen[1]	0.05 c.c.	0.1 c.c.	0.2 c.c.	0.3 c.c.	0.4 c.c.	0.5 c.c.
Positive serum[2]	−	−	−	−	−	+
Negative serum[3]	−	−	−	−	−	−

Antigen[1]	0.6 c.c.	0.8 c.c.	1 c.c.	1.5 c.c.	2 c.c.
Positive serum[2]	++	+++	+++	++++	++++
Negative serum[3]	−	−	−	−	−

[1]Bouillon culture of strain BH-2 of organism isolated from skin lesions.
[2]Immune erysipelas or rotlauf serum prepared in Germany.
[3]Normal hog serum.
− = Complete hemolysis.
+ = 25 per cent inhibition of hemolysis.
++ = 50 per cent inhibition of hemolysis.
+++ = 75 per cent inhibition of hemolysis.
++++ = Complete inhibition of hemolysis.

Table 6.—Serological Test with Jensen Culture and "Rotlauf" Serum

Antigen[1]	0.05 c.c.	0.1 c.c.	0.2 c.c.	0.3 c.c.	0.4 c.c.	0.5 c.c.
Positive serum[2]	−	−	−	−	+	+
Negative serum[3]	−	−	−	−	−	−

Antigen[1]	0.6 c.c.	0.8 c.c.	1 c.c.	1.5 c.c.	2 c.c.
Positive Serum[2]	++	+++	+++	++++	++++
Negative Serum[3]	−	−	−	−	−

[1]Bouillon cultures of strain J-80 of *B. erysipelatis suis* obtained from Prof. Jensen.
[2]Immune erysipelas or rotlauf serum prepared in Germany.
[3]Normal hog serum.
− = Complete hemolysis.
+ = 25 per cent inhibition of hemolysis.
++ = 50 per cent inhibition of hemolysis.
+++ = 75 per cent inhibition of hemolysis.
++++ = Complete inhibition of hemolysis.

DISCUSSION OF RESULTS

These results would seem to establish beyond question the close relationship between the organisms we have isolated and the known organisms of swine erysipelas as obtained from Prof. Jensen.

The fact that none of the five strains of the organisms which were isolated from the different cases of "diamond skin disease" possessed sufficient virulence to produce erysipelas in the inoculated pigs might upon first thought seem to be sufficient evidence that they are not a true type of the erysipelas or rotlauf bacillus. However, after making a study of the literature on the subject, and especially with regard to the experimental inoculations of swine, it soon becomes apparent that it has not proved an easy matter to transmit swine erysipelas artificially to healthy hogs, and not only so, but it has been found to be a rather difficult undertaking even in those localities where the disease is prevalent in the acute form.

Preisz (8) in referring to the virulence of the erysipelas bacilli states that the organisms, particularly those in cultures, soon lose their virulence for swine, and that the injection of cultures is not often successful in producing the disease. He also credits Voges and Schutz with having found in their experiments that cultures sufficiently virulent to kill hogs may become so attenuated in the course of a few days that they will produce only "urticaria" in these animals.

Jensen (9) reached the conclusion that "the erysipelas bacillus is really an almost universally occurring saprophyte," and in connection with his efforts to produce the disease in healthy swine he says: "It has hardly ever been proved possible to transmit the disease to hogs either by feeding parts of organs of dead hogs or by injections with pure cultures." Further on in the same paper, in referring to the bacilli isolated by him from the tonsils of swine, he says there was no doubt in his mind that these organisms were genuine erysipelas bacilli, but he was unable to produce the incontrovertible proof by infecting pigs with these organisms.

Stockman (10), in referring to certain peculiarities of swine erysipelas, says that the disease may at times assume such a mild type as to be completely overlooked, while at other times it may appear as a virulent and fatal enzoötic. In a later report

(11) he makes the statement that "the microbe passes a saprophytic existence in the soil, and the affected pig is only one of the factors in the up-keep of the virus."

The existence of the erysipelas organism as a saprophyte, and the difficulties experienced in transmitting the disease artificially, would tend to strengthen the opinion that the organism acquires an increased virulence, sufficient to produce the disease, under certain conditions and influences which are not understood at the present time.

CONCLUSIONS

It has been proved conclusively that urticaria or "diamond skin disease" in Europe is caused by *Bacillus erysipelatis suis* or rotlauf bacillus. The invading organisms in this mild form of the disease are no doubt very much attenuated. The failure, therefore, to infect healthy pigs with cultures obtained from the chronic type of lesions, which are otherwise typical of *B. erysipelatis suis*, should not, in the opinion of the writer, be taken as evidence that such organisms are not a true type of the erysipelas bacillus. This would seem especially true in view of the difficulties, previously referred to, which investigators have encountered in their endeavors to produce the disease in healthy pigs with what they considered as virulent cultures.

The evidence obtained relative to the organisms isolated from urticarial lesions of swine in the five different cases as described in this paper, particularly with regard to their characteristics culturally and serologically, and also in their pathogenicity for the small experimental animals, would seem quite sufficient to warrant the conclusion that these organisms are a type of *B. erysipelatis suis*, and finally, that the disease of urticaria or "diamond skin disease" now existing in the United States should in the future be classed as a chronic form of swine erysipelas, just as it has been considered heretofore in European countries.

The writer acknowledges his indebtedness to Dr. H. W. Schoening of the Pathological Division for valuable assistance rendered in connection with the serological work done.

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Dr. John Blattenberg and Mrs. Blattenberg will sail for Europe on June 1st. Doctor Blattenberg goes as a delegate to the International Rotary Convention at Edinburgh. From Edingurgh they will go to London, Brussels, Antwerp, Paris, visiting the battlefields of France and the Rhine River. They will also visit Italy and Switzerland. Doctor Blattenberg says they have booked passage on a British ship—not an American "dry dock."

In the *Quarterly Bulletin* of the Louisiana State Board of Health for September, 1920, Dr. W. H. Dalrymple has a timely and instructive article entitled "The Sanitary Control of Anthrax or Charbon."

S. R. Johnson, D. V. M., graduate of the Veterinary School of the Kansas State Agriculture College, with several years' experience in pathology, has been given an appointment in the Division of Serology of the Michigan Department of Health. Dr. Johnson, in addition to his serological work with the Health Department, will do diagnostic pathology for the Department of Animal Industry.

The Nebaska State Board of Examiners of Veterinary Medicine will hold their next regular examination in Lincoln June 20. Applications should be on file not later than June 1. For information and application, address H. H. Antles, Department of Public Welfare, State House, Lincoln, Nebraska.

GASTRIC MOTILITY STUDIES IN THE GOAT AND THE HORSE[1]

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SCIENCE is constantly becoming more complete in all of its various branches, each passing year or fraction thereof bringing additional contributions in the form of some rare discovery, some theory verified and made a scientific fact, or the recording of new theories of a tenable nature. That branch of science dealing with life in all of its manifestations must of necessity be richly endowed with theoretical premises, more so than is true of the other scientific fields. However, theories and the grounds for their existence are very essential in the process of arriving at a true interpretation of life processes. Even though the theory may be fallacious in part of its entirety, it may suggest lines of thought which assist other investigators of the particular problem.

In the field of physiological research there exist certain problems the solution of which has received but little attention, and the sum of our knowledge consists in most instances of vague theories possessing no original experimental evidence. The physiological activity of the stomach has received but casual attention until very recently. Early pioneers of physiology advanced a large number of theories, but were unable to found their conclusions upon experimental observations. While the degree of interest in this portion of the alimentary tract has always been very great, the difficulties to be encountered in the investigational work have blocked all efforts until of recent date.

In studying the stomach as it presents itself in the different animal species the striking feature of differentiation in structure is to be noted. This organ in the different animal species presents a variety of shapes, forms and sizes. It ranges from a mere dilation in a comparatively straight tube, as found in some of the lower vertebrates, to a tortuous labyrinth-like structure in some of our higher mammals. Apparently the single compartment stomach reaches its highest degree of development in the mammalia represented by man, dog, horse and pig. In the

class ruminata an entirely different structure is met with. Instead of a well-developed single pouch, the organ is composed of a series of four distinct compartments which make up the stomach complex.

The stomach occupies a very important position in regard to organismal economy in both man and beast. The relative frequency with which we encounter local and constitutional disturbances and lesions in pathological anatomy and clinical medicine, as the result of gastric inefficience, reveals to us its real physiologic significance.

It is not necessary to go back very far in medical history to where the entire fabric of stomach activity and of digestion processes in general was almost wholly based upon superstition and mysticism. It appears as though real knowledge based upon careful observations and investigations was slow to dawn in this particular line of science. We still meet with physiological texts which elaborate upon the "millstone" and "churning" activities of the stomach. While it may be possible to stretch the imagination to connect either or both of these time-honored mechanical processes with the stomach digestion in man, bird or beast, the present-day student of physiological processes can not afford to form such mental pictures of stomach activities in the light of our present knowledge of stomach motility in man and dog.

A survey of the literature shows the field of stomach motility work practically wholly unexplored in the majority of our domesticated animals. Even the very fundamentals and rudiments have not been approached in an experimental way. Thus it will be seen that our teachings in this line for past centuries have been based almost entirely upon guess-work, hearsay, and imaginations of theorists. We should not, however, forget to acknowledge that some valuable information has been gathered from surface movements shown through the abdominal musculature and skins of ruminants.

These researches have been begun with the idea of establishing, if possible, some definite and reliable data in regard to the true motor functions of the gastric apartments or stomach in some of the higher mammals. Inasmuch as the field is practically virgin, it is necessary that all the different phases of motor activities of the stomach be investigated. In order to approach the problem in a systematic manner, we are provisionally dividing the motor processes of the stomach into three periods:

1. The hunger period, which comprises the empty or partially empty stomach.

2. The feeding period, from the time the animal begins eating until digestive contractions put in their appearance.

3. The true digestion period, when the stomach is actively engaged in digestion.

HISTORICAL

The hunger activities have been most admirably worked out in man. Here the investigators have the advantage of the human element to deal with, which means much. When man is the experimental animal he can readily explain the sensations experienced, and being capable of reasoning, can help greatly in arriving at more correct interpretations. The position that man occupies in the evolutionary scale, together with occasional gastric fistulæ met with in clinical medicine, renders man pre-eminently the subject for gastric physiological investigations.

There have been two occasions in medical history when investigators have taken advantage of accidental gastric fistulæ in making physiologic studies of the human stomach. In the early 30's of the last century, Beaumont (1), a French-Canadian army physician stationed at an army post in Canada, found a patient, Alexis St. Martin, with a gastric wound which developed into a permanent gastric fistula. Here in the wilds, with only traveling-bag laboratory equipment, Dr. Beaumont set about making observations, under difficulties indescribable, upon the stomach of this patient. Although many of his interpretations do not conform to our present-day findings, his work was the real beginning, and stands as a monument to diligence, perseverence and genuine investigational spirit.

Haller (2), the great physiologist, stated in his Elementa one hundred and fifty years ago that "the stomach of a hungry, starving man is contracted" and that the sensation of hunger was due to the rubbing of the folded mucosa due to this contraction. We may state that the theory of the empty stomach being in continuous contraction has not only been questioned but denied and proven false. Schiff (3) in 1867 wrote that "the movements of the empty stomach are rare and much less energetic than during digestion," and Valenti (4) as late as 1910 stated that "contractions in the empty stomach are rare and feeble."

The foregoing statements are excellent illustrations of how

misleading our teachings may be. Careful investigation of these teachings finds them entirely without experimental evidence and based wholly upon guesswork and the vagaries of dreaming scientists. Commercial book writers cram such things into volumes which are inflicted upon the student world as texts.

The early years of the present century brought forth some important and fundamental facts in regard to stomach motor phenomena, especially the hunger or starvation phase. Boldyreff (5) in 1905, working with the balloon method with dogs, demonstrated conclusively that the empty, hungry stomach exhibits alternate periods of strong contractions and absolute quiescence, at least during the first three or four days of fasting. He did not think that the contractions gave rise to the "hunger sensations." It remained for Hertz (6) in 1911 to interpret these contractions as the cause of the hunger urge.

Cannon and Washburn (7) of the Harvard Medical School made the next big step by confirming Boldyreff's findings, but using man, Washburn himself, as the experimental animal. They found that the periods of contraction in the empty stomach are synchronous with the periods of hunger sensation, and that each separate contraction is synchronous with a hunger pang.

In 1912 Dr. A. J. Carlson of the University of Chicago was fortunate enough to obtain a man with a permanent gastric fistula. The fistula was of about twenty years' standing, the result of a constricted esophagus, from accidentally drinking caustic soda. This man, Fred Vleck, a Bohemian by birth, showed normal health conditions both before and after the fistula was made. At the time the investigations were begun upon his stomach he was about 28 years old. At this time (1912) we may consider the beginning of the Carlson school for physiological research upon the stomach. Professor Carlson and a large band of graduate students have investigated practically every phase of stomach motor phenomena imaginable, and have made some forty published contributions to the physiology of the stomach of man and experimental animals. Carlson carefully checked the work of Boldyreff, Cannon and Washburn, and confirmed their findings in the main. He and his pupils and co-workers have carried the work much farther than all preceding workers and established the fact that a certain type of contractions of the empty stomach, or nearly empty stomach, gives rise to the sen-

sation of hunger by stimulation of sensory nerves, not in the gastric mucosa, but in the submucosa or muscularis. This finally establishes the peripheral or gastric origin as the essential element in the sensation of hunger.

INVESTIGATIONAL PROCEDURE

There are three available methods for studying the motility of the stomach of man and some of the domestic animals:

1. Direct inspection by means of a permanent opening (gastric fistula) into the stomach through the abdominal wall.

2. The introduction of a rubber balloon into the stomach, either through the esophagus or through the gastric fistula, and recording the variations in pressure on the slightly distended balloon due to contractions of the stomach.

3 By means of X-rayography and fluoroscopic apparatus and obtaining graphic records of the stomach movements. To this may be added in man the recording of the subjective sensations.

It will readily be seen at the outset that all of these methods are not applicable in the larger mammals. In man and the smaller animals like the dog and the cat all can be applied very satisfactorily. In the horse, for example, where the peritoneal cavity is very spacious, and where the stomach is located a considerable distance from the body walls, the idea of permanent attachment and gastric fistula is absolutely out of the question. Also the uncertain factor of surgical interference in the peritoneal cavity of the equine species renders the success of such an operation highly improbable.

At the present time we are not in a position to carry out X-rayography and fluoroscopic observations. However, this line of investigation is projected, and as soon as conditions are favorable this method will be studied.

In consideration of the fact that the direct inspection method is impossible and X-rayography and fluoroscopic methods are not available, we are compelled to rely upon the rubber balloon for our preliminary studies. We have learned that with the necessary precautions and the proper technique this method can be carried out with excellent reliability.

RECENT DATA

The recorded data of the past clearly show that gastric motility studies have reached their highest degree of perfection in

man. Since we are dealing with dumb beasts, wholly devoid of reason, thought and will and lacking in the element of subjective sensations to aid us in our interpretations, we are attacking our problems in a comparative way and using mainly the results obtained upon man as a criterion.

By the use of a delicate balloon (8), placed in a normal empty stomach of man, properly distended with air, and correctly adjusted to a delicate manometer-recording device, we find the following pressure variations as established by the Carlson school:

1. Periods of powerful rhythmic contractions alternating with periods of relative quiescence. As these individual contractions cover approximately 30 seconds, they are termed contractions of 30 seconds rhythm. The entire contraction period is provisionally designated as the hunger period, and the individual contractions in the period as "hunger contractions."

2. A tonus rhythm (tonus contraction of the fundus) of wonderful uniformity in rate, but fluctuating in amplitude, the rate varying from 18 to 20 seconds with an average of 20 seconds. The tonus rhythm increases in amplitude without change in rate during the periods of powerful rhythmical contractions of the fundus and are weakest immediately after these periods. They are always present in the empty stomach of man, provided the subject is in good health. For the sake of brevity these are provisionally designated as "20 seconds rhythm." The methods used by previous workers were evidently not delicate enough to detect the tonus rhythm, and hence they concluded erroneously that the empty stomach of man is completely quiescent between the periods of the strong hunger contractions.

3. A pulse pressure rhythm always present.

4. A respiratory pressure rhythm always present.

In periods of relatively powerful contractions, the individual contractions usually begin as a feeble tonus rhythm, gradually increasing in amplitude with shortening of the intervening pauses, and may or may not end in tetanus or prolonged tonus contractions, followed by a relatively abrupt relaxation and quiescence.

When the contractions are relatively feeble, the periods of activity are always short, the variations being from 6 to 20 minutes with an average of 12 minutes. The number of strong

contractions in these periods varies from 10 to 25 with an average of about 14 contractions. The duration of each individual contraction is approximately 20 to 25 seconds. The stronger contractions are usually in the middle of the periods, the initial and last contractions being the weakest. In no case does such a period end in tetany.

The more powerful contraction periods exhibit some characteristic features. The periods always begin with weak contractions with long intervening pauses, which may be of several minutes' duration. Then the individual contractions gradually increase in amplitude, and the intervening pauses become shorter, until the climax is reached in a number of very powerful and rapid contractions approaching incomplete tetanus, which usually lasts from two to five minutes. The cessation of the periods of activity is always abrupt. The ending of the contraction period in an incomplete tetanus appears to be characteristic of young and vigorous individuals. In older people the period usually ends in a single vigorous contraction without tetanus except under certain conditions. The tetanus ending appears to be an evidence of relatively great tonicity of the stomach.

The stomach of dog has perhaps had more attention than that of man, and the motor phenomena of the stomach of prematurely born puppies to very old adult dogs have been worked over very extensively. In the main the results coincide very favorably with those in man, but of course with some variations and differences. All three methods of investigation can be applied with success when studying the dog's stomach.

RUMEN MOTILITY IN THE GOAT

It is the classical work and results obtained in man and dog that gave inspiration for the present researches. Fully realizing the wide unexplored field in this work in a number of animal species concerned in veterinary medicine, we have projected plans covering a broad scope of motor phenomena work in the horse, ruminants including the goat, the cow and the sheep, and the pig.

These investigations were begun in the fall of 1915, when one of us (Schalk), working in the Hull Physiological Laboratories at the University of Chicago, selected the goat for the experimental animal and began observations on that part of the gastric complex known as the rumen. The stomach of the goat, like that

of all ruminata, is composed of four compartments—the rumen, the reticulum, the amasum and the abomasum. From a biological viewpoint the rumen corresponds to the cardiac portion of the single stomach. This compartment was selected for our preliminary work. Anatomically the rumen occupies almost all of the left half of the abdominal cavity, and extends from the ventral part of the seventh intercostal space almost to the pelvis. It is compressed laterally from side to side, extending to the median line ventrally. Deep longitudinal surface grooves divide it into dorsal and ventral sacs. Internally the grooves are continued as muscular pillars, which are simply continuations and thickenings of the muscular walls. This reinforced muscular arrangement makes it a very powerful organ. The mucosa presents a peculiar roughened surface due to the numerous papillæ spread over it. Physiologically it is considered a store-room for maceration purposes and holding the ingesta until they are eructated and regurgitated for the act of rumination. Its mucosa contains no glands, hence it secretes no enzymes for digestive purposes. Its functions are supposed to be mechanical, except the bacterial changes wrought by the bacteria carried in by the food.

The dorsal sac lying in close proximity to the parietal peritoneum and abdominal wall renders conditions ideal for the production of gastric fistulæ. The surgical operation for same is simple and can be performed very satisfactorily by means of local anesthesia. It is perhaps best to make two separate operations, as follows: The site is located in the left flank region about 3 inches ventral to the transverse processes of the lumbar vertebra, at a point about midway between the posterior border of the last rib and the external angle of the ileum. After the usual surgical cleanliness is carried out upon the field of operation and the instruments and hands of the operator and assistant, a one-inch incision is made through the skin and fascia; the muscle layers are divided with blunt instruments rather than severed with a sharp knife. After the peritoneum is pierced the rumen wall is grasped with forceps and drawn about one inch through the opening and anchored to the body wall by means of silk ligatures. From four to six stitches are sufficient, but care should be taken that the ligatures should pierce the skin and musculature of the body wall and only the serosa and plain musculature of the rumen. If the mucosa is penetrated

healing takes place slowly and with difficulty. The wound is now treated by the dry pack method and left undisturbed for about 3 or 4 days, when a second operation is performed. After removing the pack the operator takes a sharp sterile knife and cuts out the circular convex protruding portion of the rumen wall just inside the sutures. A medium soft rubber tube is now inserted in the fistulous opening, secured to gauze and repacked. Daily treatments for 3 or 4 days usually find the wound healing rapidly, the mucosa finally uniting with the skin similar to that seen at the natural openings of the body. After a few days the animal apparently suffers no inconvenience from the operation, and to all apperances the disturbed function is negligible. It may be necessary to place a rubber tube in the opening from time to time in order to keep the fistula from becoming too narrow and interfering with the work. Observations can be started on about the third day after the second operation and can be continued indefinitely if the nourishment of the subject is looked after in the usual manner.

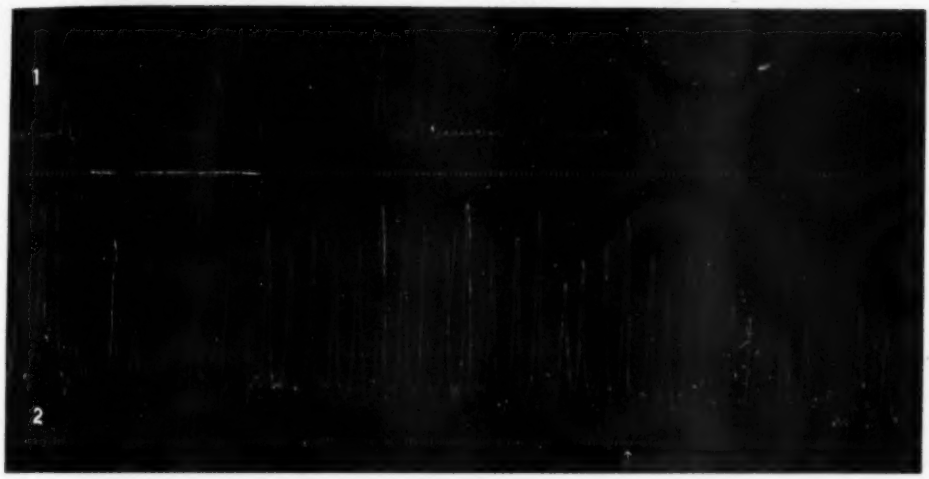
Some difficulty was encountered with the first goat in keeping the fistulous opening closed during the active digestion period. The powerful peristaltic waves forced the semiliquid ingesta from 4 to 6 feet through the opening if unobstructed. It was found impossible to pack and bandage the opening securely enough, and as a result large quantities of nourishment were lost to the patient. He soon refused food, ceased to ruminate, lost rapidly in flesh, and in fact the life of the animal was endangered. This condition was finally overcome by taking a tube of a small foot-ball bladder, with about two inches of the adjacent rubber, and slipping two layers of gauze over the tube. The adjacent rubber together with the gauze was rolled into a scroll about the tube and passed into the fistulous opening. When once in the rumen the rubber and gauze uncoiled and were then drawn up against the inner side of the opening. A pad of gauze was now slipped over the tube and secured by means of a safety pin, and no further trouble was experienced. In the course of a week to ten days the subject had regained normal conditions.

The rubber balloon, air transmission, and water manometer devices, as will presently be described under technique in the horse, were used for recording results.

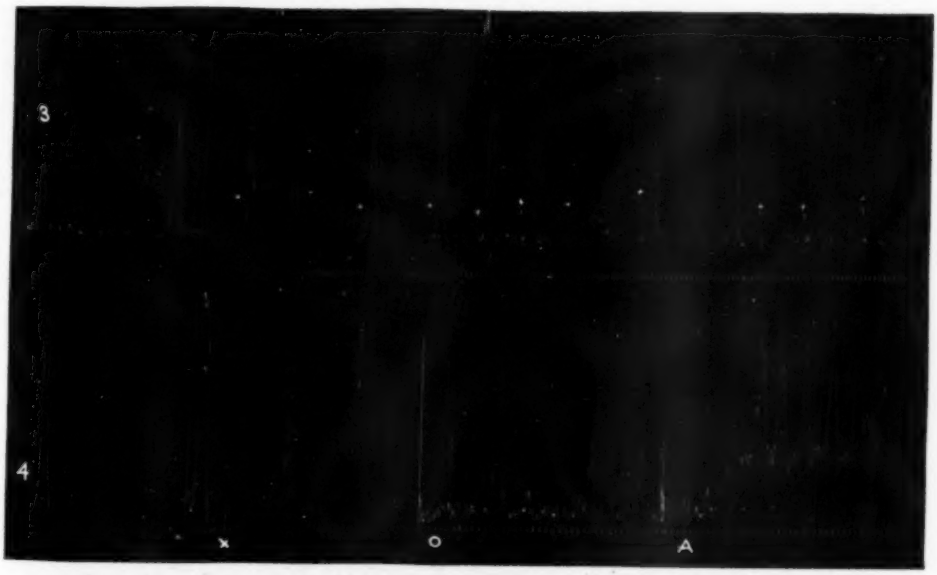
As the rumen is never completely empty in the goat, digestion is more or less of a continual process, and hunger manifests itself when the rumen is partly filled with food. This is probably true in all herbivora, as it has been shown to be the case in both the rabbit (9) and the guinea-pig (10). The body of the rumen exhibits strong periodic contractions. It appears as though the peristaltic waves of the digestive period are of the same type and frequency as those contractions recorded during the period when the rumen is partly empty and the animal is manifesting many external symptoms of hunger. When fasted for several days, or when a large amount of the food is removed through the fistula, the contractions become stronger, with practically no change in rate. Provisionally, these contractions may be termed "hunger contractions." The quiescent periods which alternate with the contraction periods in man and the dog are entirely lacking in the goat. It may be possible that this feature will be brought out in one of the other gastric compartments, presumably the fourth stomach or abomasum. Thus for the present the only evidence we have of motility hunger manifestation in the goat is possibly the increased tonus and the increased contractions, as are shown on the graphic records, when the rumen is only partially filled and the animal hungry.

Although only two animals have been subjected to experimental conditions, it appears as though a significant fact has been established in regard to rumen motility during the actual feeding period. Graphic records show that as soon as food reaches the partly filled hungry rumen there is a rapid and pronounced motility response (Graph 2). As soon as one minute after the animal has swallowed food there are initiated strong, rhythmical and continuous contractions which follow one another with practically no intermission between. Such motility can not be aroused by the animal eating indifferent material. I frequently tried this experiment by feeding the goat paper, rags, cotton and such sundry articles which seem to appeal to the vitiated appetites of the goat species, and never succeeded in arousing such motor activity (Graph 3). This feeding type of contraction always subsides at the time the feeding period is completed and gradually passes over to the regular digestive contractions.

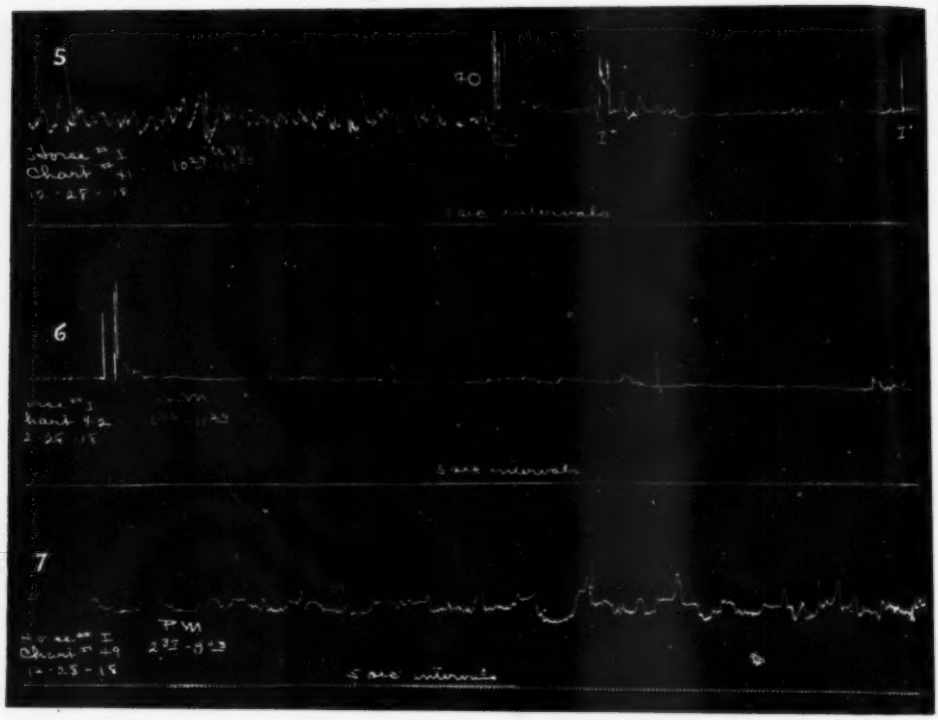
In our first goat we also observed a constant eructation con-



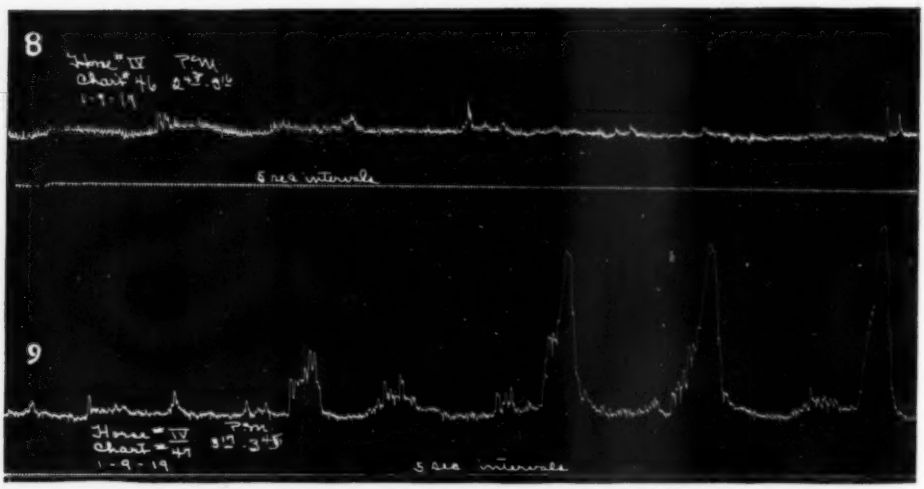
Graph 1.—Normal rumen peristalsis of goat. Graph 2.—Eating oats. Finished eating at point marked by arrow. This graph follows Graph 1 with 2 minutes' interval. Note the rapid, powerful feeding contractions.



Graph 3.—Goat, after drinking 1 liter of water, 30 hours after feeding. Graph 4.—First two hunger contractions 52 hours after feeding. At X attempted to feed rags; refused. At O fed paper and cotton. Ate, but no feeding motility. At A animal began eating oats (normal food). Observe prompt motility.



Graph 5.—Horse at end of feeding period. At FO merging into complete quiescence. Graph 6.—Continued from Graph 5. Graph 7.—About three hours after feeding. Stomach emerging from dormancy.



Graph 8.—Horse during period of complete quiescence in hunger. Graph 9.—Quiescence emerging into a period of powerful hunger contractions; 56 hours since feeding.

traction (Graph 4), which always initiated regurgitation and the act of rumination. This was a fast explosive movement, such as one would expect to bring about the expulsion of a bolus of food from the rumen into the esophagus. A most noteworthy factor in connection with these eructation contractions was that they were always immediately followed with a powerful digestion or hunger contraction such as the case may be.

Upon my return to our own laboratories these experiments were carried out upon a second goat, and the powerful contractions following the eructation were entirely lacking. As this animal was aged and in very poor condition, finally dying in the midst of the experiment, I have discarded all data obtained from this animal and shall reserve conclusions upon this phase of the work, awaiting further data.

We realize that the foregoing data are very meager and insufficient for definite conclusions. However, we are offering them for what they are worth as a matter of record, and as soon as conditions will permit the work will be thoroughly gone over on a number of animals and also carried to the abomasum or fourth stomach.

HORSE STOMACH MOTILITY

In centering our attention upon the horse we find that this particular field has not been invaded by problem seekers to any marked degree. The small store of knowledge we possess at the present time upon the general physiology of the stomach of the horse has been attained almost wholly by postmortem examination. This method of study is very primitive, fosters grave errors of conclusion, involves considerable economic loss, and on the whole does not impart knowledge of the subject which is complete in any detail. This, however, has been the only means of obtaining information of this character, however meager, as the fistula method is met by insurmountable obstacles, the most important of which is that the peritoneal resistance of the horse is very low and an invasion of the peritoneal cavity is fatal, except in rare cases. We speak of course of major procedures which require an extensive incision and considerable manipulation of parts before completion, and such is the case when we perform a gastrotomy. With the operative requirements in mind, let us spend a few moments in reviewing the anatomy of the stomach of the horse.

Anatomical Considerations

Located in the left upper portion of the abdominal cavity, the stomach presents itself as a sharply U-curved diverticulum. It is especially interesting to note the small size of the organ as compared with the size of the animal, the capacity being between 3 and 4 gallons. The cardia or portal of entrance to the organ and the pylorus or outlet are in close proximity, the cardia being almost directly above the pylorus. The dorsal extremity of the organ forms an extensive blind pouch or cul de sac, termed the saccus cæcus, which extends 8 to 10 inches above the cardia. The antrum pylori is not as distinct or as extensive as is noted in the human stomach, being about 3 inches in length. It is separated from the main portion of the stomach by the central sphincter, a band of circular muscular fibers. Both the point of entrance and exit are guarded by well-developed sphincter muscles.

Upon viewing the interior of the organ we find a distinct separation of the mucous lining into two portions. That noted in the saccus cæcus presents a similar appearance to the mucosa of the terminal portion of the esophagus and is termed the esophageal or cuticular region. The pyloric end of cavity is covered by glandular muscosa which elaborates the gastric juice, and the two portions of the mucosa are separated by the elevation of the mucous membrane known as the margo plicatus.

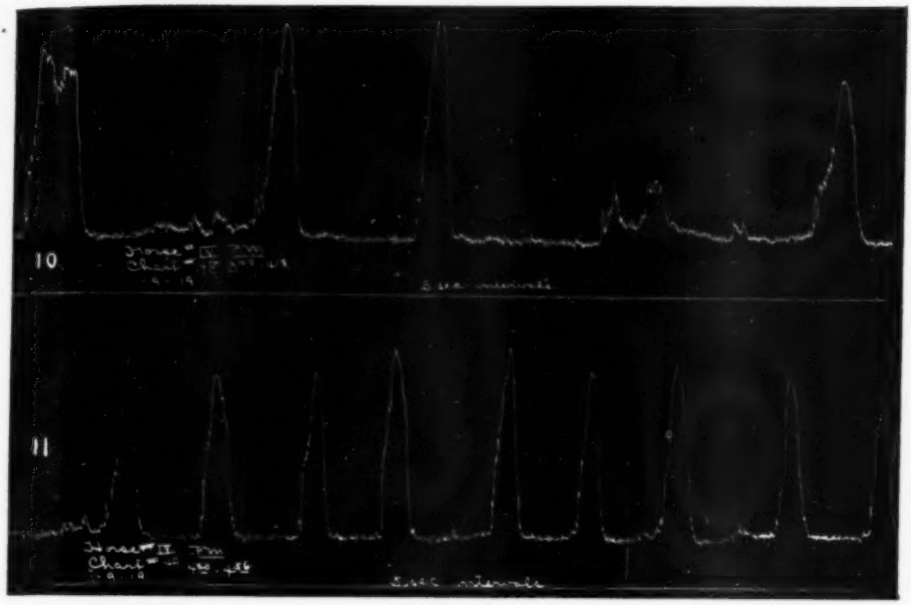
These brief facts are all that are essential for an understanding of the problem, both from the standpoint of the above-mentioned difficulties in the establishment of a fistula to the stomach of the horse, and also certain other phases such as position of the balloon.

Method and Technique

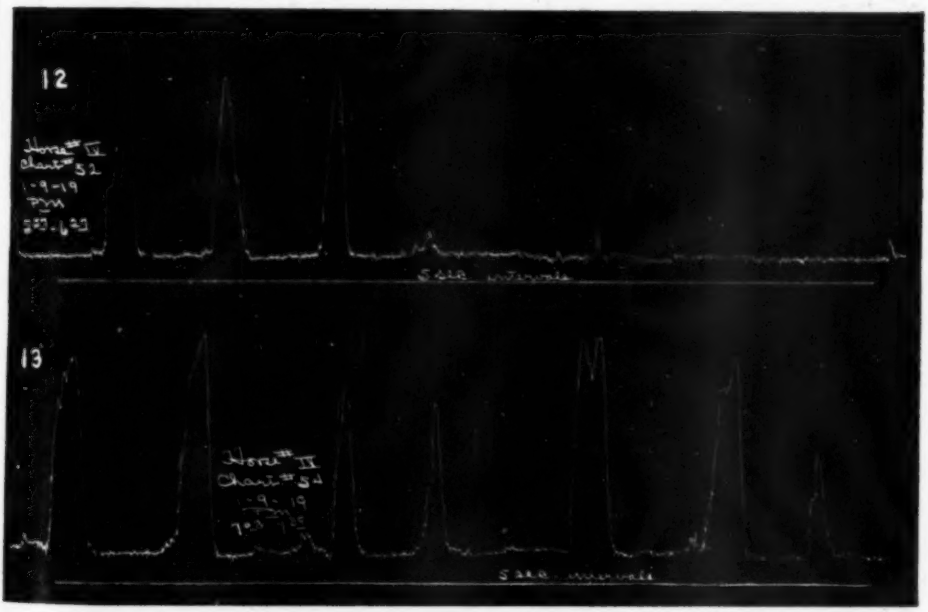
The balloon method appears as the only available means of obtaining any record of the activity of the equine stomach, and the only question to be solved was how to place the balloon in the organ.

Arrangements were made during the holiday season of 1918 to start the work with the following methods of procedure:

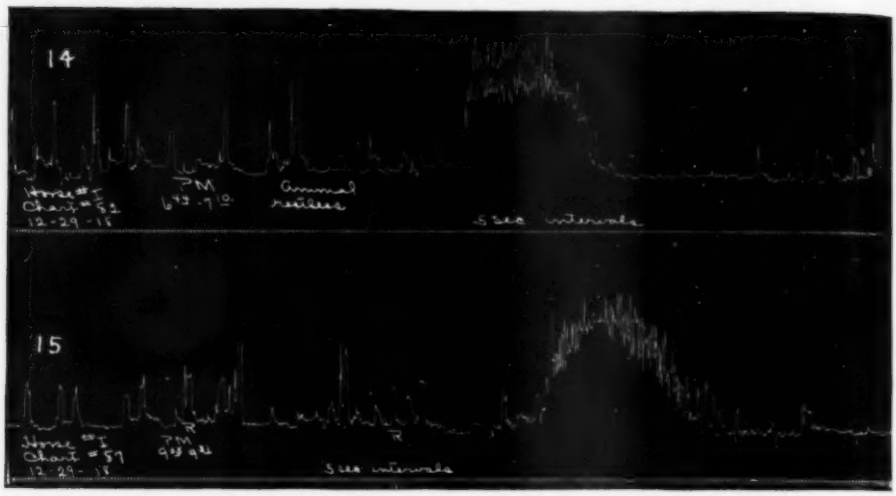
The horse was secured in the stocks with a dental halter adjusted. This being a very mild means of restraint, the ordinary animal would soon become accustomed to it, and the records would not be affected by the restraint factor.



Graphs 10 and 11.—Continuation of Graphs 8 and 9. One-minute intervals between graphs in this group.

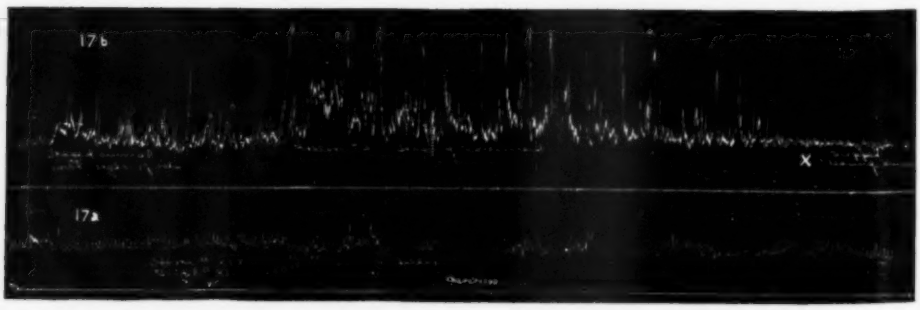


Graph 12.—Sudden change from active to quiescent condition; 60 hours since feeding. Graph 13.—Thirty-five minutes after Graph 12.



Graphs 14 and 15.—Hunger periods ending in complete tetany. Note exhaustion following tetany period.

Graph 16.—Typical tetany cut short by psychic effect of sight of food.



Graph 17a.—Without food 44 hours. Graph 17b.—Began teasing with food. Observe psychic phenomenon which follows. Teasing discontinued at X. Note limitations of psychic motility.

An ordinary toy balloon, spherical in shape, was attached to about 15 feet of generator tubing with a glass tube connection to preserve the lumen. The length of tubing was drawn through a ¾-inch lumen stomach tube 10 feet in length. The balloon was folded over the extremity of the stomach tube and the tube inserted into the stomach by way of the naso-esophageal route. The balloon was now inflated and the stomach tube withdrawn. With the inflation to prevent its return to the esophagus, and a generous lubrication of the interior of the stomach tube, the balloon was thus retained within the stomach. This method worked very well, although the preparations were somewhat extensive and the assistance of one or two helpers was required.

During the early spring months a nursing colt was acquired by the Department for experimental purposes, and we found that the insertion of the recording balloon could be made without the aid of a stomach catheter. This method has proved to be a great improvement over the former, as it does not require any assistance, can be executed in a few minutes, and causes little or no resistance on the part of the subject.

We have found our greatest trouble to be the securing of balloons of the desired quality and lightness of wall, the open market product being the only kind we have succeeded in obtaining up to the present time.

Expirations of a forcible nature, as coughing, snorting, etc., are overcome by means of a valve device in the lumen of the manometer tubing, this device closing if a sudden rise in pressure occurs as during these respiratory movements, but it does not interfere with the changes in pressure brought about by the contraction or relaxation of the walls of the stomach.

In this work thus far the water manometer has been used for the recording of pressure changes, the one manometer used carrying a water column 1 inch in diameter. The quantity of water is kept as nearly constant as possible in the manometer so that the pressure conditions will remain about the same throughout the experiment.

Further details will not be given space here, although it might be stated that with the preparation and preservation of over 1,500 charts thus far obtained sundry improvements have been made so that the charts can be preserved in excellent form.

Incidental Features

During the last year we have had a number of horses available after they had served their purposes for other experiments. We have taken advantage of this excellent opportunity and utilized them for preliminary stomach motility work. The most of these animals were aged, ranging from 14 to 20 or more years of age. Thus our data apply largely to the stomach beyond the middle age of life.

From the beginning we realized that we had some very difficult and perhaps insurmountable obstacles to overcome. The variations in distance from the nasal openings, through which the tube and balloon are passed, to the stomachs in different sized horses renders definite and correct calculations impossible. As a result we can not ascertain with any degree of certainty in which portion of the stomach the balloon is operating. Different types of motility are registered, and it must be determined what portion of the stomach is producing a given type of motility under certain conditions. In an attempt to solve these problems we have planned to destroy a number of animals immediately following the recording of a certain type of motility and marking down the balloon definitely. In addition we have devised a double tube system in which one balloon precedes the other by about 6 to 10 inches, thereby causing the first balloon to be carried deeply into the stomach and the second one to remain just inside the cardia. In this manner we can obtain records from two different portions of the stomach simultaneously or alternately.

By application of the double balloon system during different stages of fasting and following different feeding experiments, and following up with postmortem examinations, we believe we will be able to arrive at more correct conclusions upon this particular phase of the work. Up to the present time a few horses have been destroyed at given periods, but as the single balloon only has been used, and these were in stomachs without solid food, but containing liquid, the balloons are usually found in the same place, and of course floating upon the liquid. Hence we are not in a position to make reliable statements in regard to same at this time.

Our studies up to the present time have been spread over 19 horses. Among this number we encountered some in which the

stomach motility followed no particular type of movements found in other animal species. These, however, were among the older animals, in poor condition, and apparently the stomach tonus was disorganized. In such cases they were discontinued after a few preliminary records were taken, and the results were discarded. In the majority of the animals in fair to good condition the different phases of stomach movements appeared to be rather constant and to follow more or less definite lines. In such cases they have been subjected to considerable investigation, and from 100 to 200 graphic records have been taken from them.

We wish to state that our study and survey of these graphs at this time are only preliminary and rather superficial. We fully realize that in the final analyses they will require the most careful study and consideration in order that we may be able to interpret them definitely and correctly, if such a condition is possible.

Results of the work to the present time as gathered from the graphic records are as follows:

1. There appears to be a prompt and decisive response on the part of the hungry stomach when normal food reaches it. The response is in the form of powerful contractions, executed with great rapidity, with practically no quiescence intervening. This type of contractions ceases at the end of the feeding period (Graphs 5 and 6). As these contractions are not constant under all conditions, we are not certain at this time whether there is a certain localized place in the stomach to which these contractions are confined or whether the balloon is just inside the cardia and records motility from the cardia and possibly the lower portion of the esophagus. We do not believe the latter condition prevails, inasmuch as an exact simile of these contractions was met with in the rumen of the goat.

2. In certain subjects, following the feeding period the stomach falls into a period of almost absolute quiescence, which may continue for hours. However, the graphs show that it gradually comes out of this period to regular digestive activity (Graphs 6 and 7). This same condition, although of shorter duration, has been demonstrated in the fundic portion of man, infant and dog. We had grave suspicions at first that the balloon on such occasions was jammed in some corner of the stomach as the result of ingestion of full-sized meals and simply could

not operate. From the fact that it always emerges from these periods of quiescence to real activity, we have taken a different view of the matter. A few postmortems at the proper time will materially aid us in clearing up this condition.

3. The graphs conclusively showed to us in the earlier stages of our studies that hunger is shown in the horse's stomach when it contains relatively large quantities of food. It manifests itself in the form of more or less powerful contractions which may set in as early as five hours after taking an ordinary meal. They usually begin small, gradually increasing in amplitude until very powerful contractions are reached (Graphs 8 and 9). The time required for these contractions varies from 30 seconds to one and a half minutes, and they may provisionally be termed "hunger contractions."

These hunger contractions present themselves in periods and groups which may be designated as "hunger periods." The number of individual hunger contractions which make up the hunger periods seem to show, as far as we have investigated, a wide variation, ranging from 10 or 15 to 100 or more in some horses. In fact they are almost continuous in some animals. The time intervening between the individual contractions in a hunger period also shows considerable variations, ranging from 2 to 10 minutes or even more. In some very old horses in poor condition, presumably having weak, atonic stomachs, we have records showing the individual contractions one minute apart, very weak, and only a few contractions in a hunger period.

Further studies upon the quality and quantity of food in the stomach may throw additional light upon this phase of the work. The age and general tone of the stomach may also be a factor.

There appears to be something characteristic about the manner in which the hunger periods terminate. So far three different types have been observed.

(*a*) Where the individual hunger contractions build up gradually until the highest amplitude is reached, and then gradually decrease in height, receding to a relatively quiescent period.

(*b*) A second type is observed where the individual hunger contractions gradually increase in amplitude and numbers, ending in a series of very powerful hunger contractions, and breaking off into quiescence very abruptly (Graphs 10, 11 and 12).

(*c*) Begins identically the same as those described in the preceding type, but goes into what is termed "hunger tetany." A hunger tetany is a rather pronounced and abrupt rise in tonus and intrapressure, and continues for a period of time ranging from 3 to 5 minutes or until apparently the muscularis becomes exhausted or paralyzed. There is then an abrupt fall in pressure, complete loss of tonus, and a subsequent quiescent period following. Such activities are known as "complete tetanies" (Graphs 14 and 15). However, all these tetany periods, especially in different individual animals, are not complete. They pursue the same course up to the tetany, but are of shorter duration and apparently do not go to the paralytic or exhaustion stage. When the fall of pressure and tonus sets in they do not drop into complete quiescence, but continue showing individual contractions which usually lack in rhythm and are of smaller amplitude than those recorded just preceding the tetany.

In addition to the foregoing types we have some records showing irregular conditions which at this time can not be classified. It may be possible that with more data gathered from a large number of subjects they can be placed in a specific class.[1]

4. A relatively quiescent period following the hunger periods. This quiescence ranges from 15 minutes to 1 hour or more in some animals. Data on this phase of the subject show a greater variation in the horse than in man and the dog. Likewise it is less constant in the horses we have investigated than that shown in man and dog. The fact that the horse's stomach is rarely found completely empty may partially or fully explain the phenomenon.

5. Tonus waves. It is definitely established in man, and to a lesser degree in the dog, that the stomach shows a tonus rhythm that is present during actual digestion and especially that period leading up to the hunger contractions. While we have some evidences of these rhythms shown in our preliminary work, we are inclined to believe that our inconsistencies in this phase of the work can be attributed to a heavier type of balloon that we have

[1]In Horse I, which showed rather constant tetanies, we desired to determine the psychic effect of food upon the tetany period. At the height of a tetany, food was placed before the animal, just outside his reach, with expectation of getting food, and teased in this manner. There was almost an immediate cessation of the tetany, the period being less than half the average length of the tetany period in the animal (Graph 16). In this case there was no quiescent period following. At the close of another complete tetany in this same animal, just at the beginning of a quiescent period, the animal was fed oats. There was an immediate cessation of the quiescence and a prompt response with typical feeding contractions described above.

been forced to use. It was only with an extremely thin-walled balloon that this phenomenon was brought out in man and dog. The powerful muscularis in the equine stomach, together with the rough food element natural to the species, renders this particular type of balloon undesirable for horse stomach work.

The foregoing observations have been gathered from some 1,500 graphs recorded from 19 different horses. The investigations so far are mainly of a general nature, and we consider our work just a beginning. From the general results in hand we shall now attempt to follow certain phases of the work in detail. In so doing we hope to make further contributions to the phenomena of gastric motility in the horse and other domestic animals concerned in veterinary medicine.

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DISCUSSION

DR. CONNAWAY: Dr. Schalk, have you taken any diseased conditions of any animals?

DR. SCHALK: I might say that we considered these graphs on 12 different horses, a mere beginning. We propose, as time permits, to follow this phase of the work more in detail. We did follow the course of a case of colic. We had a case of acute indigestive colic. The horse had not been fed for 48 hours, and we fed him too heavily, and it was only a short time until he was unmanageable. We have projected considerable work on the action of different drugs. There is a lot of physiological work to be done on this before we really attempt the therapeutic action of drugs.

SALPINGITIS IN THE COW

I. The Streptococcus as a Possible Etiological Factor

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THE NORMAL FUNCTION of the Fallopian tube is an essential link in the reproductive process and one that is frequently interfered with because of the diminutive size of the tube. The part it plays in the control of sterility has been quite generally ignored except in those cases where gross pathological changes can be observed clinically. Ordinarily it is not considered as a factor in the diagnosis of sterility except in those cases in which enlargement of the tube can be readily palpated. Laboratory examinations have proven that extensive alteration of the tube takes place without macroscopic changes, thus giving salpingitis a much more important part in the diseases of the genital organs than it has been given previously. To judge from the laboratory and clinical findings, this disease is very widespread and is of great economic importance to the livestock industry. More attention has been given in the past to other parts of the genital tract, but our observations support the conclusion that the Fallopian tubes should be given consideration, at least in the diagnosis of most cases of sterility.

There can be found practically no veterinary literature on this subject, and in most cases mention only has been made of its existence. Williams (1) describes pyosalpinx, hydrosalpinx and tubercular salpingitis. Recently Gilman (2) has studied their microscopical pathology and has taken up in detail several conditions which have not been described before. The most important of these changes was a catarrhal inflammation accompanied in some cases by a partial or total atresia of the lumen due to a chronic proliferative inflammation. On macroscopical examination he found most of them apparently normal. Little or no work has been done on the bacteriology except that which has been done recently by Carpenter (3) on the bacteriology of the entire tract.

The diseases of the oviduct have been thoroughly studied in

human medicine and are considered an important factor in temporary and permanent sterility in women. Tweedy (4) states that the cause of 50 per cent of female sterility, in spite of curettage, will be found to lie in tubal disease. The pathological changes found in human work, except cases of gonorrheal infection, are essentially the same as those found in the work of the veterinarian. The same is true of the bacteriology. Miller (5) summarizes 120 cases of sterility, 46 of which are due to salpingitis. Twenty-five of these cases are due to the gonococcus, 12 to the streptococcus, 6 to infections originating in the vermiform appendix, 2 to adhesions after tubal pregnancy, and 1 to tuberculosis. These results are characteristic of those obtained by other gynecologists, that is, that salpingitis is a common cause of sterility and is often due to streptococcic infection.

The oviduct is a very small, tortuous tube, 21 to 28 cm. long, running from the uterine apex to the corresponding ovary. It is supported in a fold of the utero-ovarian ligament known as the mesosalpynx. At the ovarian end the tube spreads out into a fan-shaped prolongation, the pavilion, which normally lies in close contact to the ovary. At this end the tube is 3 to 5 mm. in diameter and gradually diminishes to 0.8 to 1 mm. in diameter at the uterine end.

Microscopically the oviduct consists of three coats, the serosa, the musculosa and the mucosa. The serosa is the simple peritoneal covering. The musculosa consists of a thick inner circular layer and a thin outer longitudinal layer. The muscle is thickest at the uterine end and gradually becomes much thinner at the fimbriated end. The mucosa is lined with a pseudo-stratified, ciliated, columnar epithelium. The basement membrane is absent in the cow. The function of the oviduct is to convey the spermatozoön from the uterus to the fimbriated end of the tube and the fertilized ovum to the uterus.

Observations on a large number of cases from several herds have proven that salpingitis is quite common and in a large percentage of cases may be diagnosed clinically. Although it is usually observed in multipara, it is not uncommon in heifers which apparently have never conceived. Under certain conditions it may become endemic in a given herd, and it is from one of these herds, which apparently has carried a streptococcic infection for ten years or more, gaining in intensity as time

progressed, that we have been able to obtain considerable material for study. The following table gives in brief the relation of the salpingitis to the breeding condition of the herd:

Total cows in herd September 1, 1918	87
Clinical salpingitis	23, or 26.4 per cent
Out of 23 cases of salpingitis:	
Sterile	14
Aborted prematurely or retained placenta	6
Reproduced normally	3

That 3 out of 14 cases showing clinical salpingitis did breed all right after having been affected is surprising, especially since there were 9 sterile cows from the same herd having no clinical lesions, all presumably having salpingitis. Several of these cases were autopsied and in each there was salpingitis without any accompanying macroscopical changes.

In another group of 26 cows, 20 were diseased, as follows: Clinical salpingitis, 7, sterile; other lesions, 13, of which 10 were temporarily sterile and 3 permanently sterile. Of the 3 permanently sterile animals with lesions other than salpingitis, *Bacillus pyogenes* was recovered from the uterus of 1 and streptococci, apparently identical with those found in the oviducts of the other animals, were isolated from the uterus of the other 2.

In still another herd which had been severely infected for a number of years 52 females were examined. Disease in them occurred as follows: Salpingitis, 14; cystic corpus luteum, 2; cervicitis, 6. Nearly all these were permanently sterile.

It will be interesting to consider the previous breeding history of several of the animals from one herd which has been most closely observed. In one group of 18 sterile animals slaughtered on account of sterility, the previous calvings of 6 had been apparently normal, 4 had retained placenta and metritis, 4 had previously aborted, and 4 heifers had never conceived.

In many instances salpingitis appears to follow cervicitis, and especially in those herds having a great deal of cervicitis is the development of salpingitis quite common. Our data show that the condition follows no definite lines of symptoms but that in a vast majority of cases it succeeds an inflammation in other portions of the tract. In some it appears after apparently normal parturition, while in other cases it may appear in heifers that have never conceived.

It is usually a few weeks or several months after the indications of the obvious primary infection that the salpingitis

appears. The primary infection may or may not be recognized, depending upon its intensity or whether an examination of the animal was made at the proper time to observe it. Occasionally there may be seen the swollen or ectropic annular folds, indicating a subsided cervical inflammatory process. Clinically, permanent uterine lesions are not common, but the uterus probably forms a transitory host, and once the barrier formed by the internal os is broken down and the endometrium invaded, there is little to prevent the entrance of bacteria into the tubes. The definite progression of the infection may occassionally be recognized until it finally causes gross changes of the tube and surrounding structures, which may become apparent by digital examination.

The first symptom of the inflammation to be noted is a uniting of portions of the pavilion by means of fine strands of connective tissue to the anterior distal aspect of the ovary, to which it normally lies in very close relation. The presence of these adhesions, even when very minute, may in a great many cases be readily detected on digital examination by one who is familiar with the clinical examination of the tubes. Sometimes there are strands of connective tissue going from all parts of the tube to adjacent structures, but in this case the tube is usually not clinically defined, the ovary, tube and mesosalpinx forming a conglomerate, adherent mass. The pavilion may become entirely adherent to the ovary in severe cases. If the osteum abdominale becomes occluded, or if an occlusion occurs at other parts of the tube, hydrosalpinx may result. This condition may be observed throughout the entire length of the tube, while in other cases it may present a nodular form with constrictions in several places. On the other hand, a large percentage of the genital tracts presents no observable macroscopic changes unless there be abnormal changes in the corpus luteum or other parts of the ovary.

Most of the animals studied were condemned for breeding purposes and slaughtered for beef. Their tracts were removed carefully as soon as the abdominal cavities were opened. They were wrapped in sterile towels and brought to the laboratory, where the pathological and bacteriological examinations were made.

The gross examination shows no marked difference from the lesions described clinically. On section a thick, yellowish, viscid

exudate, appearing like pus, usually oozes from the cut end of the tube, but on microscopical examination only epithelial cells, a mucoid material, and occasional bacteria are seen. Histologically, the conditions observed in the tube are usually some form of a catarrhal inflammation, ranging from an acute exudative endosalpingitis to a chronic catarrhal inflammation of all layers with obstruction of the lumen by granulation tissue in the more chronic cases. In acute exudative endosalpingitis there is merely a fibrinous or serous exudate into the lumen, with hyperemia of the mucosa and loss of cilia in many instances. The chronic form is characterized by frequent loss of the lining epithelium, a profuse exudate in the lumen, thickening of the folds by a productive inflammation, and the resulting narrowing, more or less, of the lumen. In the acute catarrhal form affecting all layers, the muscularis and serosa show hyperemia and more or less exudation between the muscular and connective tissue fibers. Edema, pressing the muscular fibers apart, is seen occasionally, and even may be so severe as to cause atrophy of the tissue elements. Muscular hypertrophy, on the other hand, is rarely seen, and when present is supposed to be due to a prolonged effort to expel the constantly produced exudate. The chronic form differs from the acute condition by the fact that all coats are, as a rule, affected. Partial or total atresia of the lumen is often brought about, and frequently the intermuscular connective tissue is increased, causing more or less atrophy of the muscular fibers. A cellular exudate into all coats is usually seen, particularly in the mucosa. As has been mentioned before, in hydrosalpinx there is occlusion of the lumen at one or more points, causing an accumulation of the serous fluid. The mucosa in these cases is not materially altered. The epithelium is usually intact, the wall being much thinner and more or less translucent, due to almost complete atrophy of the muscular and serous coats.

The bacteriology of this work has been carried out in connection with a complete bacteriological examination of the entire tract. This seemed preferable because a better relation of the microörganisms in the other parts of the genital canal to those found in the tubes was thus obtained. To date, the bacteriology of the oviducts of 43 animals slaughtered because of sterility has been completed. Seventeen of these came from one of the larger herds. *Streptococcus viridans* has been isolated either from the

tubes or from the adhesions adjacent to them in 14 out of the 17 cases.

Streptococcus hemolyticus was recovered in 2 cases associated with *Streptococcus viridans*. Staphylococci were mixed with the *Streptococcus viridans* cultures in 7 instances, and an unidentified organism was recovered once. In 1 case *Streptococcus viridans* was not found in the oviducts but a culture with the same characteristics was isolated from the uterus. The remaining 26 animals came from 12 different herds. Streptococci were isolated from 14 cases, the majority of these being of the *viridans* type. Staphylococci were recovered from nine cases, occasionally in pure culture but mixed as a rule with the streptococci. Twice, organisms from the colon-aerogenes group were recovered. In six cases no organisms were isolated from the tubes.

The *Streptococcus viridans* which has been recovered is a short-chained streptococcus and the separate segments are distinctly oval in shape. Sometimes it is difficult to distinguish them from rods. Some strains have been isolated in which the individual cocci were very large, and in a few cases comparatively long chains have been observed, but this is not the rule. The few strains of hemolytic streptococci that have been recovered are distinctly different in morphology from the *viridans*. These cocci are decidedly spherical, occur in longer chains and are much smaller.

Only two case reports are given, because they represent the typical history, clinical and laboratory findings of most of the animals examined.

CASE 2483

History

Born October, 1916. Bred October 3, 1918. Aborted May 11, 1919, having retained placenta.

May 19, 1919, acute catarrhal inflammation of the vagina. Uterus is slightly enlarged. Iodoform placed in vagina.

June 2, 1919, vagina slightly constricted; organs otherwise apparently normal. Dichloramin T injected into uterus.

July 15, 1919, organs apparently normal.

August 11, 1919, organs apparently normal. Corpus luteum present in right ovary.

August 20, 1919, organs apparently normal. Corpus luteum removed from right ovary. Treatment, none. Could not enter cervix.

September 27, 1919, bred.

October 17, 1919, bred and conceived.

June 20, 1920, dead calf expelled, followed by placentitis.

June 23, 1920, retained placenta. Iodoform-oil injected into uterus.

September 10, 1920, corpus luteum in right ovary. Acute catarrhal vaginitis. Vaginal atresia.

October 6, 1920, slaughtered.

Autopsy

Left ovary, 3 by 1.5 by 1.3 cm. Distal end has an area, 5 mm. in diameter, which opens into a cavity. It is apparently a place where a Graafian follicle has ruptured and the corpus luteum is forming. A little lutein tissue is seen. There is a small cyst or follicle at the distal end. Remainder of ovary is made up of connective tissue.

Right ovary, 3.5 by 2 by 1.5 cm. Distal end contains an apparently normal corpus luteum, 1 cm. in diameter. Adjacent to this is a small cyst, 6 mm. in diameter.

Right and left oviducts, apparently normal. They are small in diameter and walls seem thickened and firmer than normal.

Uterus—Body of uterus, 7 cm. across dorsal surface. Horns 4 cm. in diameter at base. Walls 1.2 cm. thick at base of horns and body of uterus. Cotyledons show up very well. Mucosa is sprinkled with petechial hemorrhages which appear like hog-cholera hemorrhages. There is a small amount of yellowish, cloudy muco-pus in uterus.

Cervix, 7 cm. long, apparently normal. Contains some of the same secretions found in the uterus.

Vagina, normal. Contains some of the same secretion found in the uterus.

Bacteriology

Left uterine apex, negative.
Right uterine apex, negative.
Right ovary, corpus luteum, negative.
Right oviduct, negative.
Left oviduct, *Streptoccoccus viridans*

Microscopical Pathology

Right oviduct, uterine end, profuse cellular débris and exudate in the lumen. The epithelium is entirely gone. Chronic catarrhal exudative endosalpingitis.

Middle—Some fibrinous exudate in lumen. Epithelium is entirely denuded.

Pavilion—Epithelium entirely gone and there is a moderate fibrino-cellular exudate in the lumen. Some folds are growing together while others are shrinking up. Chronic catarrhal exudative endosalpingitis.

Left oviduct, uterine end, chronic proliferative inflammation with a few small groups of epithelial cells remaining. The folds are entirely obliterated.

Middle—A moderate fibrino-cellular exudate in lumen. The epithelium is entirely gone. The folds are undergoing a proliferative inflammation and are commencing to occlude the lumen.

Pavilion—A slight exudative endosalpingitis.

CASE 1050

History

Born 1915. Has never had a calf nor conceived.

November 16, 1917, general condition good. Right ovary is 1½ in. cystic. Left ovary 1½ in. cystic. Cysts removed. Breeding advised.

February 15, 1918, vagina showed granular vaginitis. Small cyst or follicle ruptured from right ovary. Small corpus luteum removed from left ovary. Advised douching uterus several times.

August 26, 1918, possibly pregnant.

November 14, 1918, uterus slightly enlarged. Oviducts not examined. Uterus douched and dichloramin T oil injected. Advised breeding.

November 15, 1918. Since this animal had not conceived for such a long period and was also tuberculous, she was slaughtered.

Autopsy

Right ovary, 3½ by 2 by 1 cm. The proximal end has a corpus luteum, 2 cm. in diameter, containing a small cyst in center. There is a cyst, 1 cm. in diameter, at side and base of the corpus luteum.

Left ovary 2 by 1 by 1 cm. Capsule slightly adherent to pavilion by fine strands of connective tissue.[1] Contains atrophied corpora lutea and small peripheral follicles.

Right oviduct, apparently normal.

Left oviduct, apparently normal except for adhesion of pavilion to ovary.

Uterus, slightly enlarged and wall firm. Diameter of dorsal surface at body, 7 cm. Base of horns, 4 cm. in diameter. Thickness of walls, 8 mm. at body; at apex, 3 mm.

Cervix, 6 cm. long, contains a little cloudy mucus.

Vagina, normal.

Bacteriology

Corpus luteum, right ovary, *Streptococcus viridans.*
Adhesions, left ovary, *Streptococcus viridans.*

Microscopical Pathology

Right oviduct, acute catarrhal salpingitis.
Left oviduct, chronic catarrhal salpingitis.

The control of salpingitis depends upon prophylactic measures, inasmuch as most diseased tubes constitute insurmountable barriers to conception, and treatment, with the exception of the expectant treatment, is impossible in so far as our present knowledge is concerned.

There is considerable evidence to show that genital infections may be transmitted from dam to offspring in utero. It is not uncommon to find certain families that are inefficient from the reproductive viewpoint. Our attention is frequently called to certain cows, all of whose female offspring fail to reproduce properly, and in some of these, clinical lesions will be found in the oviducts. Further, the occasional finding in aborted fetuses of streptococci having similar cultural and morphological characteristics to those commonly found in diseased tubes, together with the extreme chronicity of this type of infection, suggests strongly a transmission from the dam. The development of lesions in many nullipara, recognized after service to apparently sound bulls, leads us to the assumption that the infection may be carried along in a latent form in the genital tract from calfhood, being intensified sufficiently for the formation of lesions at sexual maturity or following the severe strain incumbent upon the state of pregnancy. The evidence at hand is not sufficient to prove the exact relationship of infections in the dam to those in

[1] The adhesions following the removal of the corpus luteum from the left ovary are very typical.

their offspring, but we do believe that it is quite sufficient that the veterinarian and breeder should consider seriously this aspect of the question. Calves for foundation stock should be born from healthy parents, in a healthy environment, and kept free especially from those infections which cause digestive disturbances and pneumonia.

We have little or no evidence showing that tubal infection may be of direct hematogenous origin. If this were the case, little could be done to prevent it. On the other hand, the prompt and adequate control of vaginal, cervical and uterine foci of infection seems to be successful as a prophylactic measure. Prevention demands that too much emphasis can not be placed on the early recognition of infection in other portions of the genital tract, and the early adoption of such measures as will eliminate the source of infection and prevent its conveyance into the tube.

From observations in this work, it seems as though ovarian massage and pressing out corpora lutea, especially those that are cystic, are always attended with a certain element of danger. This has been proven in many cases by the prompt adhesion of the pavilion to the ovary and the formation of fibrous strands to the neighboring parts, following the removal of a corpus luteum. An open wound is formed at the place where the corpus luteum is ruptured, and if infection is present in the ovary or pavilion it immediately starts an inflammation which spreads in the form of a localized pelvic peritonitis.

Salpingitis is apparently very prevalent among animals suffering from sterility. In one group of 1,221 cows with genital lesions, examined in routine clinical work, tubal disease was recognized in 187, or 15.3 per cent. The actual amount of salpingitis is much higher than this and can not be shown by figures, owing to the impossibility of recognizing clinically those forms without adhesions or tubal enlargement. While we do not consider it a primary infection, as it usually follows an infection in some other part of the tract, still it may be the primary lesion causing permanent sterility. The streptococcus, particularly the *viridans* type, seems to play an important part in the etiology of this condition. In human medicine it is considered, without doubt, the cause of salpingitis in a considerable percentage of cases except those of gonorrheal origin.

In the course of experimental work one interesting case seems

worthy of mention. Five mils of a live suspension of a streptococcus, isolated from a cystic corpus luteum and uterus of an animal slaughtered on account of sterility, was injected with a hypodermic syringe directly into the uterus of a two-months-old calf that appeared healthy. This was done after exposing the uterus through the flank. The calf remained apparently healthy throughout the experiment. Sixteen days later the calf was slaughtered for veal and the uterus was carefully removed and examined. The uterine apices, ovaries and oviducts were all adherent in a mass with fat. The pavilions were adherent to the ovaries; in fact the lesions were very similar to those that have been found in the sterile animals which we have examined. A streptococcus with identical characteristics of the organism injected was recovered in pure culture from the adhesions and from the mucus in the vagina. Many genital tracts of veal calves have been cultured, and almost without exception all of the cultures have been negative. No lesions resembling these in any way have ever been observed in veal calves that have not been injected for experimental purposes.

TABLE 1.—BACTERIOLOGICAL RESULTS FROM OVIDUCTS OF STERILE COWS SLAUGHTERED IN ONE HERD

No. of Animal	Right Oviduct	Left Oviduct	Adhesions
16	*Strep. viridans*, staphylococcus.	Staphylococcus.....	
17	Staphylococcus.....	Negative.....	*Strep. hemolyticus*, *Strep. viridans*.
27	.....	.....	*Strep. viridans*.
28	Negative.....	Negative.....	
29	.....do.....	.....do.....	*Strep. virdans* from body of uterus.
30	.....do.....	.....do.....	*Strep. viridans*.
44	*Strep. viridans*, staphylococcus.		
45	*Strep. hemolyticus*.....	.....	*Strep. viridans*.
46	*Strep. viridans*, staphylococcus.	*Strep. viridans*.	
48	.....do.....	Unidentified rod.	
49	*Strep. viridans*.....	*Strep. viridans*.....	*Strep. viridans*, *Strep. hemolyticus*.
50	.....do.....	*Strep. viridans*, staphylococcus	
52	Negative.....	*Strep. viridans*.....	Negative.
53	*Strep. viridans*.....	.....do.....	
59	Negative.....	.....do.....	
60	.....do.....	Negative.	
62	.....do.....	.....do.....	

TABLE 2.—BACTERIOLOGICAL RESULTS FROM OVIDUCTS OF STERILE COWS SLAUGHTERED IN TWELVE HERDS

No. of Animal	Right Oviduct	Left Oviduct	Adhesions
2	Colon-aerogenes	Negative	
3	Negative	Staphylococcus.	
4	do	do.	
5	Streptococcus	Streptococcus, staphylococcus.	
8	Negative	Negative.	
9	do	do.	
12	do	do.	
13	Staphylococcus	Staphylococcus.	
14	Streptococcus	Negative	Streptococcus.
15	do	do.	
18	Negative	do	Streptococcus.
19	do	do.	
20	*Strep. hemolyticus*	Staphylococcus.	
21	Negative	*Strep. hemolyticus*	Streptococcus.
24	*Strep. viridans*, staphylococcus.	Negative	*Strep. viridans.*
25	*Strep. viridans*, *Strep. hemolyticus.*	*Strep. viridans*	*Strep. viridans*, *Strep. hemolyticus.*
26	Negative	do.	
36	Staphylococcus, streptococcus.	Negative.	
37	Negative	Streptococcus.	
38	Staphylococcus	do.	
39	Colon-aerogenes.		
40	Staphylococcus	Staphylococcus.	
41	Negative	Negative.	
51	do	*Strep. viridans.*	
58	*Strep. viridans*	do.	
61	Negative	Negative.	

The only solution of the problem, with our present knowledge, seems to be in the prompt removal of the primary sources of infection when they can be reached. It is hoped that more veterinarians will realize the great importance of tubal disease and make an earnest effort to recognize and control this form of sterility.

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TUBERCULOSIS OF EQUINES AND ITS IMPORTANCE IN TUBERCULOSIS ERADICATION BY THE ACCREDITED HERD PLAN [1]

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TUBERCULOSIS of equines is generally considered of little economic importance. Statistics, especially those compiled in countries where horses are slaughtered for food purposes, show but a very small percentage affected. The majority of veterinarians have practiced for years without seeing a case of equine tuberculosis. Of the thousands of horses which are destroyed and autopsied annually by Federal and State authorities, as well as those dying in hospitals where postmortem examination is a routine, there are but relatively few cases of tuberculosis reported. It is true that all cases would not necessarily be reported in our journals, but when one converses with those who have been afforded the best opportunity for observing autopsies on large numbers of equines he is more impressed with the scarcity of the disease and is led to look upon it as of no economic importance either as regards animal industry or public health.

With these facts plainly before us it would be like making a mountain out of an ant-hill to say that equine tuberculosis is of any great economic importance, but what can be said is that horses exposed to tuberculous bovines may be a greater menace to livestock and public health than they have hitherto been regarded.

For convenience we can divide horses into two classes, viz, unexposed and exposed. The first class includes those kept in city stables, in separate barns on farms, or so they are not directly exposed to tuberculous bovines. It is chiefly from this class that our present data have been gathered. The second class includes all horses directly exposed to infection, such as those kept in contact with tuberculous cattle or in the same barn with little or no segregation. It is to this second class, or, better, the

[1] Contributions from the Bureau of Animal Industry of the Pennsylvania Department of Agriculture, New Series No. 2.

exposed horse, to which our attention should be drawn. This is by far the smaller group of the two, but of the greater importance as regards tuberculosis.

The greater the progress in tuberculosis eradication the more important this question becomes. The larger and better herds have been the first to come under the accredited herd plan, but as time goes on and the work expands, more and more herds on small, poorly managed farms will be included. The number of exposed horses will then increase, as it is more common to have both species in close contact on the small farms.

Since 1913 but one case with no history of exposure has come to our notice. This was an aged animal kept for years in a large city stable and which was destroyed on account of a suspicious reaction to ophthalmic mallein. The writer autopsied this case and found a calcified lesion in the mediastinal lymph gland. No lesions of glanders were found. A bacteriological examination revealed tubercle bacilli of the bovine type.

During the last two years four cases of tuberculosis in horses have been brought to our attention, all of which were exposed animals. The following is a brief summary of these cases:

Case No. 1.—April 4, 1919, Dr. L. A. Pratt, Rome, Pennsylvania, submitted sections of lungs and spleen to the laboratory with a request that they be examined for tuberculosis. The lesions proved to be tuberculous and the organism of the bovine type. This animal had been exposed to bovines which had never been tested and which there is reason to believe were infected. This case has been reported in more detail by one of my colleagues, Dr. M. F. Barnes, in this journal, September, 1919.

Case No. 2.—January 27, 1920, Dr. Pratt submitted sections of lungs and spleen which showed extensive lesions of tuberculosis from the team mate of the foregoing case. The lesions in both of these cases showed a striking similarity. Smears in both cases showed acid-fast organisms in great numbers and the type of organism in both was the same.

Case No. 3.—Specimens of mesenteric lymph glands and intestines of a horse were submitted by Dr. A. Berg, Doylestown, Pennsylvania. The glands were greatly enlarged and caseated. The intestines revealed tuberculous ulcers from the size of a dime to that of a dollar. The type of bacilli proved to be

bovine. This case was investigated and the following history obtained:

The owner purchased it from a dealer about eight years ago. Last spring it began to lose flesh and did not seem well. During the summer it failed to pick up and in the fall it began to lose more flesh. During this time attention had been given its teeth and tonics administered. From the 9th of November its appetite varied. Fever developed, 101 to 103. Antipyretics were given, but the fever remained about 102. There was frequent urination. A rectal examination was made and a tumor was located in the sublumbar region which was diagnosed as a melanotic sarcoma. The owner was advised to slaughter the animal, and an autopsy revealed a tumor weighing 25 pounds. The mesenteric lymph glands in the posterior portion of the intestinal tract were enlarged, some to the size of an egg. The cecum and the colon showed many ulcers with ragged edges, from the size of a dime to that of a dollar. Other organs were apparently normal.

The barn where this animal was kept was poorly lighted and ventilated and adjacent to the cow barn, both under the same roof. In the stable there were ten cows which were in fair condition but had never been tested. All animals drank from the same watering trough.

Case No. 4.—A case of tuberculosis in a mare was reported by Dr. A. B. Potteiger, of Selinsgrove, Pennsylvania. This animal was on premises where a tuberculin test was to be applied under the officially accredited plan. On December 15 and 16 the test was applied to the cattle, and at the same time the horse was tested, with the result that a positive reaction was obtained. Eleven of the fifteen cattle reacted. The accompanying chart shows the reaction obtained. The owner also had a herd of cattle destroyed about five years before which was tuberculous. This mare was in close contact and pastured with the first herd as well as the second. On account of the presence of scars on the nasal septum it was thought advisable to eliminate glanders, so a blood sample was submitted to the laboratory, and this gave a negative reaction to the complement-fixation test for this disease.

This mare was purchased by the Bureau and shipped to the laboratory for further study. On December 1 the intrapalpebral mallein test was applied, with no reaction. On December 6 and 7 the subcutaneous tuberculin test was applied and a very sus-

Tuberculin Test Chart of Case No. 4, Black Mare, 12 Years Old

TESTS	Temperatures before injection			Dose of Tuberculin	Time of injection	Temperatures after injection									
First subcutaneous test, Nov. 10–11, 1920.....	4 p.m. 100.0	6 p.m. 100.2	8 p.m. 100.2	6 c.c.	8 p.m.	4 a.m. 105.0	6 a.m. 104.0	8 a.m. 104.4	10 a.m. 104.0	12 m. 104.0	2 p.m. 104.0	4 p.m. 104.0	7 p.m. 103.0		
Second subcutaneous test, Dec. 6–8, 1920.....	7 p.m. 101.0	9 p.m. 101.3	11 p.m. 101.4	4 c.c.	12 p.m.	8 a.m. 100.2	10 a.m. 101.0	12 m. 101.4	2 p.m. 100.0	4 p.m. 102.4	6 p.m. 102.2	8 p.m. 102.2	11:30 p.m. 102.3	1 a.m. 103.0	8 a.m. 101.0
Third subcutaneous test, Dec. 15–16, 1920.....	.....	11 p.m. 100.3	1 a.m. 101.3	12 c.c.	1 a.m.	7 a.m. 104.2	9 a.m. 104.4	11 a.m. 102.6	1 p.m. 103.2	3 p.m. 103.0	5 p.m. 103.4	7 p.m. 104.0	9 p.m. 104.0	11 p.m. 104.0	

picious reaction obtained (see chart). At the same time the ophthalmic tuberculin test was applied and gave a well-marked reaction. The intradermal test was applied simultaneously with the subcutaneous and ophthalmic tests. Three minims of tuberculin was injected in the left lip of the vulva. The reaction obtained was highly suspicious.

On December 9 the submaxillary lymph gland, which was greatly enlarged, was harpooned to obtain material for microscopic examination. The material thus obtained from the center of the gland revealed acid-fast bacilli, characteristic of the tubercle bacilli.

December 15 and 16 a subcutaneous retest was applied, the dose of tuberculin being 12 c.c. A positive reaction was obtained (see chart). Aside from the high temperatures there was a well-marked local reaction at the point of injection. This injection also caused a return of the ophthalmic reaction.

Several physical examinations were made of this animal while under our observation. There were three scars on the left nasal septum which were somewhat suspicious of glanders. The submaxillary gland was about the size of a large hen egg, hard, not lobulated or tender to touch. Two small enlargements were present in the region of the thyroid glands. No other abnormal conditions were found. Figure 1 shows her general condition the day before she was destroyed.

On December 17, 1920, this animal was destroyed, and on autopsy the submaxillary, retropharyngeal and all the cervical lymph glands on the left side were found affected. The glands on the right side of head and neck were apparently normal. Lesions were found in the anterior mediastinal, mesenteric and splenic lymph glands and two nodules in the spleen. All the small lymph nodes in the cervical region were greatly enlarged. The affected glands were greatly enlarged and very fibrous and on section showed innumerable small areas of calcification.

A bacteriological examination revealed acid-fast organisms which readily killed both guinea-pigs and rabbits with generalized tuberculosis, indicating the origin of infection as bovine.

DISCUSSION

Of the four cases cited above it is to be noted that at least three are to be classed as spreaders and the fourth if not a spreader was certainly dangerously near to that condition.

Fig. 1.—Case No. 4, Showing Condition of Animal Day Before Destroyed

Fig. 2.—Cervical Lymph Glands of Case No. 4

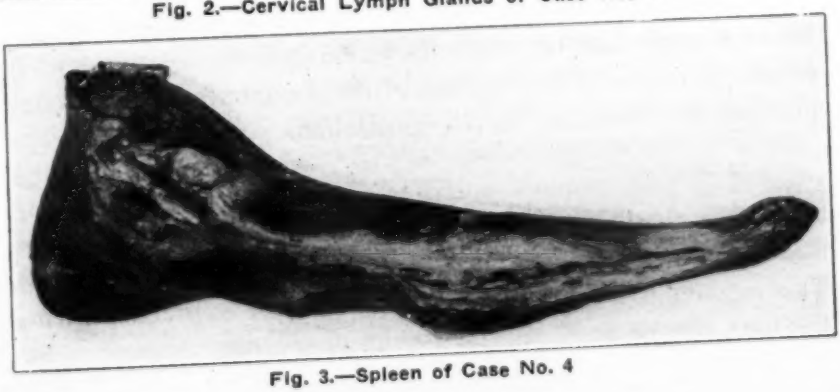

Fig. 3.—Spleen of Case No. 4

To eradicate tuberculosis from herds continually exposed to such animals would come near to being an impossibility. When we stop to think that these cases were all discovered as a result of their physical condition, we wonder how many cases would be found if special attention were given to this subject and all exposed horses tested with tuberculin. I do not mean by this to recommend such a procedure, but rather to impress the reader with the fact that horses exposed to tuberculous cattle may contract the disease and become dangerous spreaders. Therefore, where conditions point to this possibility, exposed horses should be subjected to the tuberculin test.

DANGERS OF TB. SHOWN IN MOVING PICTURES

The danger to farm animals and to human beings from the neglect of animal tuberculosis is graphically illustrated in a new motion-picture film prepared and issued by the United States Department of Agriculture under the title, "Out of the Shadows." The story has to do with the happy family of Henry Benton, a wholesome farmer, with a large and handsome herd of dairy cattle.

A Government inspector tracing an epizoötic suggests a test of the Benton herd, and gives arguments that induce Benton to consent to a tuberculin test. The result of the test shows an appalling condition, and explains the declining health of Benton's beautiful young daughter, who has drunk the milk of a favorite heifer. The clean-up of the farm and Benton's acquirement of a herd of cattle not affected with tuberculosis are results of the inspector's visit. The daughter, however, is not restored to health until after three years in a sanitarium.

The picture is in two reels and carries so strong a human-interest story together with its lesson that it is being widely sought through the loan system of the department, and through purchase by State and local organizations.

The Vermont Legislature has appropriated $400,000 to finance a campaign for clearing the State of tuberculosis among cattle. This amount will be given for the work to be conducted during the next two years.

RECORDING TUBERCULIN TESTS, WITH REFERENCE TO THE INTRADERMAL AND OPHTHALMIC TESTS [1]

By M. H. Reynolds

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THE WRITER has recently heard several livestock sanitarians urge the importance of some standard of abbreviations for tuberculin test work, and not only abbreviations but also a standard method of describing and reporting the ophthalmic and intradermal tests. Lack of something definite in the way of standard descriptions seems to be one of the things now standing in the way of recognition of the newer tests for official work. Worse still, we appear to have no generally accepted standard of reactions, and this is especially true of the intradermal and ophthalmic tests.

Taking the intradermal test for illustration, we have no accepted standard of what constitutes a reaction. Very often the official livestock sanitarian has no information concerning the operator, and the reliability of the diagnosis in this test hinges to a very great extent upon the personal factor in its administration and interpretation, even more so than in the thermal test.

It would greatly aid toward proper recognition of the newer tests if the test report submitted gave data upon which the responsible official could estimate the accuracy of the work and the typical or atypical character of the reaction. He needs something more than unknown John Doe's statement that the animal was given the intradermal test and reacted or did not react.

Especially is this true of a test where so much depends on technique and interpretation as the intradermal test, or again with the ophthalmic test where so much depends on practical experience with cattle and familiarity with conditions simulating ophthalmic reactions. In the ophthalmic test the technique is simple enough, but its interpretation is not simple. It is more than likely that if the writer could examine daily for a month the eyes of every animal in any one of the herds under his care

[1]Published with the approval of the Director as Paper No. 250, of the Journal Series of the Minnesota Agricultural Experiment Station.

for tuberculin test work, he could find conditions simulating a mild ophthalmic reaction in most of the animals one or more times during that month. In some stables these slight eye disturbances are far from rare, hence the necessity of practical experience and common sense in interpretation of an ophthalmic test. So much depends in both these tests upon the personal factor, that for official work, we must have something more than the unsupported statement of a stranger that the animal did or did not react under test.

Objection is often made, "too much trouble, too much detail," etc. The writer submits, after twenty-seven years' work with tuberculosis control, that we have had and still have altogether too much crude work with the tuberculin tests. Upon crude work, valuable cattle are condemned, and tuberculous cattle are sometimes left in valuable herds. It is quite time for a more general attention to accuracy and painstaking care. The issues at stake are abundantly worth it.

It is obvious that important details of a tuberculin test record must occupy very little space for each animal, and the record must be easily read by sanitary officials in the breeder's own State and by officials in other States to which the animal may be sent.

My offering has been a gradual development in personal work, and in use about five years, with changes from time to time for simplification or more accurate expression, until during the past two years there do not appear to have been needed any important changes for the author's personal use. At present he is able to describe any reaction accurately, by symbols, using very little space and giving detailed description of either one or all three tests in the spaces ordinarily used on the ordinary tuberculin test blank for temperatures alone.

Comparatively few of the following abbreviations are usually needed. The others are occasionally needed for unusual cases and especially for critical experimental study. Abbreviations for the thermal test are included in order to show the possibility of a complete record of any test or combination of tests in limited space. Until an operator is familiar with the few commonly used abbreviations, he can carry a card in a convenient pocket. In my work I usually have someone to record data as I call off, and hence use a small board upon which the test chart

is held with thumb tacks. In case rarely used abbreviations are liable to be needed, an abbreviation card is tacked on the under side of this board. Only a comparatively few abbreviations are needed for most cases in routine work, and these are learned during the first test.

The reader will notice that a few of the same or similar abbreviations are used for more than one thing, but the connection will always enable one to avoid confusion, *e. g.*, "S" for suspicious reactor and for subcutaneous; "A" for Angus or atypical.

The writer makes stable records in pencil, but for final important records in case of simultaneous tests he uses different color inks for thermal, intradermal and ophthalmic tests, thus avoiding the possibility of confusion *when ordinary thermal test blanks are used.* If the intradermal treatment is given at the same time as the thermal and the ophthalmic, then the intradermal records do not begin until the thermal are done, and will therefore use different columns and spaces, as in the sample chart submitted.

For the suggested test chart blank, I have modeled after the Bureau blank. The reader will notice changes, particularly with reference to animal identification and arrangement to accommodate combination tests. It is obvious that blanks suitable for either a single test or any combination of tests must be elastic. The writer found it quite a problem to work out a chart form capable of clearly and fully recording any test or combination of tests and giving convenient room for records without increasing the size of the sheet or wasting space. One line is given to a sample record of all three tests. This should be carried for at least the first lot of blanks sent out. Hours should be left blank rather than be printed in. One who sees many tuberculin test charts certainly sees enough of poorly recorded tests.

General Abbreviations

Atypical	A
Left	L
Male	M
Non-tuberculous	NT
Right	R
Retest	(R)
Simultaneous	Si
Suspicious enough to call for separation	S
Steer	(M)
Thermal test (referring to Fahrenheit)	F
Tuberculous	T
Typical	(T)

Symbols of Degree

˙ Very slight
⁝ Moderate
⁞ Marked
⁞ Extreme

Ophthalmic Test

Hyperemia	H
Lachrymation	L
Ophthalmic or eye	O
Primary or first ophthalmic	'O
Second treatment of same eye (sensitized test	O"
Pus	P

Examples

P would indicate pus about pin head in quantity. Often seen in untreated cattle.

⁝ P would record pus several times the size of pinhead.

⁞ P records a moderate amount of pus. Plain reaction but not extreme.

⁞ P means pus abundant, excessive.

⁝ H ⁞ L ⁝ P would mean a moderate hyperemia, excessive lachrymation and a moderate amount of pus.

Intradermal Test

Caudal	C
Intradermal	I
RCI would record "right caudal intradermal."	
Nothing appreciable	0
Very slight, swelling barely detected by a trained finger	+ 2
Slight, ½ to ¾ inches	+
Distinct, ¾ to one inch	++
Pronounced, 1 to 1½ inches	+++
Extreme, 1½ inches or over	++++

Estimated measurements are to the extreme limits of the perceptible swelling.

(1) Diffused[1]
[1] Defined
(2) Soft
[2] Firm
(3) Heat
[3] No heat
(4) Sensitive
[4] Insensitive
(5) About like a match head
[5] Discolored
(6) Pits under pressure

The following are selected as illustrations because they are common records in my work:

++(2) Swelling ¾ to 1 inch, soft
++[1](2) Swelling ¾ to 1 inch, defined but soft
+++[1] ⁝[2] Swelling 1 to 1½ inches defined and moderately firm
++++(3)(4) Excessive swelling, hot and tender, liable to indicate infection rather than specific tuberculin reaction

[1] In this group of symbols, parentheses represent circles and brackets represent squares. See symbols in chart.

Lest some reader may misunderstand and say "Oh, that is too complicated; it is impractical," let it be repeated that only a few small, easily remembered symbols are needed for practical field work, and these give definite record such as a responsible official who must accept or reject the record is entitled to have before him.

It is true that we have two fairly distinct types of reaction to the intradermal test, (*a*) a diffused thickening of the fold or a flat diffused swelling if injection is made below or between the folds, and (*b*) a defined tumefaction, but the writer has never felt the need of two sets of symbols for recording these, as was suggested at the 1920 meeting of the Livestock Sanitary Association. By the key submitted here, either type of reaction is easily described, e. g., +++ (1) (2) describes fully a reaction of the fold thickening type, and +++ [1] [2] describes fully a reaction of the distinct tumefaction type.

Combinations of these symbols can be used to describe accurately any reaction as desired, and to describe it to a limited extent as needed in routine work, or in minute detail and in small space if needed for research studies. A complete system is submitted because there is obvious need for a complete system, but with a final reminder that but few small, simple, easily remembered symbols are usually needed.

The following breed and color abbreviations are submitted for the man in private practice who does not have every animal tagged, or for anyone testing mixed lots. They will have little use in State or Bureau routine work, and are therefore offered as a supplementary list.

Breed Abbreviations

Aberdeen-Angus, purebred	A
Ayrshire, purebred	Ay
Guernsey, purebred	G
Galloway, purebred	Gal
Grade	g
(E. g. "Ag for Angus grade.)	
Holstein, purebred	H
Hereford, purebred	He
Jersey, purebred	J
Polled, purebred	P
Red Polled, purebred	RP
Shorthorn, purebred	Sh
(E. g., Polled Shorthorn, P Sh.)	
Brown Swiss	Sw

RECORD OF TUBERCULIN TEST

Method Intradermal - Ophthalmic - Thermal

Tag No.	Name and Markings or Registry number for Pure Breds	Breed	Sex	Age	Weight	Dose CC	Date and time of inj.	When fed & Watered	Date 9/7 temps before inj 10 AM	2 PM	6 PM	M	Date 9/8 1920 temperatures after injection 6 AM	8 AM	10 AM	12 M	2 PM	4 PM	6 PM	7:30 PM	Intradermal Records 7/8 6 PM	7/9 6 PM	9/10 8 AM	Diagnosis by tests O	I	T	General Diagnosis	Autopsy
118	Sir Launfal Lowell 236245	H	M	4	1200	5.0			1.8	2.1	2.0		P:L	P:L	P	P	P	P:D			+++	++++	++++	T	T	T	T	T
													2.3	2.9	3.8	4.6	4.2	3.0										
444	Murphy	g	F	Aged	1300	6.0			1.7	1.5	1.2		0	0	0	0	0	0	0		0	0	0	NT	NT	NT	NT	
													1.8	2.0	2.0	1.6	1.8	1.7	1.7									
289	Red	g	F	4	1400	6.0			2.0	1.2	2.3		0	0	0	0	0	0	0		++	+++	+++	NT	T	T	T	
													5.7	5.0	5.0	3.8	2.0	3.7	3.0									
299	Roan	g	F	4	660	2.0			1.4	1.3	1.5		0	0	0	0	0	0	0	0	+	+	+-D	NT	T	T	T	
													3.7	5.8	6.7	6.2	6.0	5.7	5.3	4.4								
—	V. — F. — No. —	Gh	F	10	1400	6.0			0.8	1.3	1.8		0	P:L	0	P:L	P:L:H	P:L:H	P:L		0	+	+	T	T	NT	T	
													1.6	1.4	1.5	1.2	1.1	2.0	1.3	1.3								
284	Spot r + w	g	F	4	1000	4.0			1.2	1.2	2.3		P	P	P	P	P:L	P:L	P		+++	+++	+++	T	T	T	T	
													4.3	6.0	4.6	3.5	2.7	2.2										
							9:30 AM 9/7 10: AM 9/8	4																					

Colors

Black	blk
Dark	d
Light	lt

(E. g., "lt r," light red.)

Red	r
Roan	ro
Spotted	sp
White	w

(E. g., spotted red and white, "sp r w.")

The accompanying illustrative chart carries selections from actual tests made in the course of certain research studies. For obvious reasons names and herd registry numbers are omitted in case of registered stock.

Tag No. 118 gives positive reaction to all three tests. The ophthalmic record at 6 a. m., September 8, means excessive pus and excessive lachrymation; at 4 p. m., moderate pus partially or moderately dried. His intradermal record at 8 a. m., September 11, i. e., at the eighty-second hour, means excessive swelling, i. e., more than an inch and a half long, moderately firm and sharply defined. (See chart.)

No. 244 is negative to all three tests.

No. 289 record means red, grade, female, positive on thermal, positive on intradermal, and negative on ophthalmic. At the eighty-second hour, i. e., September 11, 8 a. m., the intradermal swelling is from 1 to 1½ inches long, with no comment as to characteristics. (See shart.)

No. 297 is positive on thermal, slight but positive reaction on intradermal, negative on ophthalmic. The intradermal record on September 9, 5 p. m., i. e., forty-third hour, indicates a swelling from ½ to ¾ inch in extent. At the last reading on September 11, swelling was slightly smaller, but easily detected. The descriptive marks indicate that it was diffused but firm.

V.—F.— No. —— was negative on thermal, plainly positive on ophthalmic, slight but positive intradermal. The chart records when read in full mean for the ophthalmic record on September 8, 2 p. m., a moderate amount of pus, slight but evident lachrymation, and moderate hyperemia. The intradermal record indicates a swelling ½ to ¾ inch long at the eighty-second hour.

No. 284 record means spotted red and white, grade, female, positive on all three tests. The record for the ophthalmic on September 8 at 2 p. m. means an excessive amount of pus with slight lachrymation at that time. The intradermal on September 11, 8 a. m., indicates a swelling of ¾ to 1 inch in extent, defined and firm.

THE CAUSE AND TREATMENT OF RICKETS[1]

By H. J. Milks

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RICKETS is such a complex disorder that it seems best to preface this discussion with a definition of the disease, and since I shall occasionally refer to this malady in children, I will include two definitions, one from veterinary medicine and one from medicine.

Hoare (1) defines rickets as a "nutritional disease characterized by arrest of growth and development, delay in calcification of the osseous framework, softening and bending of the bones, enlargement of the joints, wasting of the muscles and ligaments, and, in fact, a disturbance of general nutrition."

Holt (2) says: "Rickets is a chronic disease of nutrition. While the only important anatomical changes are found in the bones, it is not to be regarded as a bone disease; but a very complex pathological process which affects the bones, muscles, ligaments, mucous membranes, and nearly all the organs of the body, particularly those of the nervous system."

The disease was first described by Glisson, an English physician, in 1650. He suggested the name rachitis or rachites as an alternative, "not because he thinks that there is any evidence that 'rickets' was a corruption of the Greek term," but because he thinks "that they that are expert in the Greek and Latin tongues may peradventure expect a name from us whereof some reason may be given." He explains that the word was selected by himself and some of his friends "because the spine was the first and principal among the parts affected in this evil." It is said that in his description he included all the ailments of children known at that time.

Theories as to Cause

Many theories have been advanced at various times as to the cause of the disease. They included unhygienic conditions, lack of sunlight, air and exercise; errors in diet, including deficiency

[1] Presented at the Thirteenth Annual Conference for Veterinarians, Ithaca, N. Y., Jan. 20 and 21, 1921.

of lime, lack of absorption of lime, lack of fat; intestinal intoxication, and defective action of the endocrine glands. More recently the cause has been attributed to lack of the fat-soluble vitamin, and, by some, to an acidosis. The following theories will be discussed somewhat at length.

Lack of Sunlight and Air.—While these factors have been given considerable support because rickets is most often seen in animals kept in insanitary surroundings and in the children of the poor in cities, they can not be regarded as specific causes, as animals affected with the disease will recover under dietetic changes without any improvement in their surroundings. Additional proofs that lack of sunlight and air are not the controlling factors are that children will contract the disease in tuberculosis sanitaria where special attention is given to the open-air treatment; that the disease is said to be rare in certain parts of the world where people live in dwellings very poorly lighted, and that it is practically unknown in the Arctic regions where the sun does not shine for the greater part of the year.

Lack of Exercise.—Although some claim that lack of exercise plays an important rôle, some other factor must enter into it because many of our better bred animals are confined in small places over long periods. Also many of our wild animals may be reared and kept in captivity if the diet is sufficient. No doubt any unhygeinic conditions may be regarded somewhat as contributing causes, but it should be noted that as a rule most animals which are kept in insanitary surroundings are also the most likely to suffer from errors in their diet.

Lack of Calcium in the Diet.—In support of this theory it has been said that without calcium it is impossible to form bone. This, of course, is true, but it must be remembered that in rickets considerable calcium is excreted in the urine, and it is rare that food does not contain even an excess of that element. Another important proof against this theory is the fact that rickets is much more frequent among children fed on cows' milk than when breast fed, yet cows' milk contains more calcium than women's milk.

Defective Absorption of Calcium.—This theory is more reasonable to believe than the preceding, but even accepting it, very little light is thrown upon the subject. Lime-water has no value in the treatment of the disease, and rickets may be prevalent in

places where the drinking water contains much lime. Of course it is possible that calcium must be in organic combination to be used.

Kassowitz suggested a relative rather than an absolute deficiency of lime. In support of this he pointed out that when he produced prolonged hyperemia of bone by intermittent constriction of a limb of a growing animal, there was proliferation of cartilage and some absorption of bone. There was excess formation of bone tissue, but not a corresponding increase in the lime salts necessary for its complete calcification. This theory presupposes some irritant that caused prolonged hyperemia and changes similar to those of chronic inflammation in the areas of bone formation. No such irritant is known, but the frequent association of rickets with intestinal intoxication or gastrointestinal trouble has led to the theory that the intestinal trouble is primary and the rickets a result of the toxemia.

Solution of the lime salts already deposited in the bone by lactic acid circulating in the blood has been claimed as a cause by some writers. According to this theory, the lime is either dissolved or prevented from being deposited in the bone. Some of the arguments used against this theory are that the blood never becomes acid in rickets or otherwise; injections of lactic acid into animals does not produce rickets; and it has been impossible to confirm the observations of the originator of this theory by work upon animals.

Lack of Fat.—For a number of years lack of fat has been regarded as the primary factor by most physicians. Osler (3) states that lack of fat or poor fat assimilation is the most important cause. Holt says that "the essential cause is dietetic, although hygienic influences play a very important rôle in its production. It appears, however, that the most essential factor is the lack of fat."

Support of this theory has been given by Bland Sutton in observations of animals in the London Zoölogical Garden. Describing these conditions, Cheadle says: "Young monkeys deprived of their mothers' milk and fed entirely upon vegetable food, chiefly fruits, became rickety. Two young bears fed exclusively upon rice, biscuits and raw meat, of which the latter they hardly ate, died of extreme rickets. For many years the lion whelps were weaned early and fed on raw flesh only; they

invariably became rickety and died. When milk, pounded bones and cod-liver oil were added to the raw meat, they lost all signs of rickets and were successfully reared." The addition of milk and pounded bones to the diet makes the experiment less conclusive than if only the oil had been added. Judging the quality of meat as that usually fed such animals, it is probable that these young lions received very little fat and that fat was the needed addition. The value of fat, and especially cod-liver oil, in the treatment of rickets suggests at least that fat is of great importance.

Defective Action of the Endocrine Glands.—It is possible that disturbances in the function of certain of the endocrine glands—thymus, thyroid, parathyroid, adrenals, etc.—may occasionally be concerned in rickets, but it is doubtful that in such a common disease any one gland can be the primary factor. The arguments against this theory are: First, rickets is a comparatively short-lived disease, while disorders of the glands are usually persistent; secondly, rickets is usually amenable to treatment through change in the diet; and finally, the use of these glands as therapeutic measures has not been as successful as once hoped for them.

Acidosis.—Pritchard (4) believes that "practically all varieties of malnutrition occurring in infancy and early childhood tend to terminate in rickets provided they are sufficiently severe or long enough continued. They should not, however, be considered as evidence of rickets unless they are accompanied by typical changes in the bones." He fits his theory to accept all the others, but claims that the chief fault is the failure of calcification or mineralization of the bone. This failure, he believes, is due to the vast requirement of the body for neutralization of the acid bodies in the blood, and the neutralization of this acidosis must be satisfied before the developing bones are supplied.

Lack of the Fat-Soluble Vitamin.—Mellanby (5), experimenting on more than 200 dogs, appeared at least to connect rickets closely with the absence of the fat-soluble vitamin. His work seems so important to veterinarians that I will review it somewhat in detail. The puppies were started on diets after weaning between 5 and 8 weeks of age, mostly the latter. In the earlier parts of the experiments he killed them after 5 or 6 months, but

as his work progressed and the diets became more rachitic, this period was considerably shortened. After he obtained diets that would produce rickets, various substances were added and the effect upon the development of the disease noticed.

Mellanby concluded that rickets is a deficiency disease. Of the three vitamins, fat-soluble A, water-soluble B and antiscorbutic, he discarded water-soluble B because yeast had no influence on the development of the disease, and the antiscorbutic on

Table 1.—Rachitic Diets

DIET 1		DIET 2	
Whole milk	175 mils.	Whole milk	175 mils.
Oatmeal and rice porridge, aa.		Bread	ad lib.
Salt	½ gm.	Salt	½ gm.

DIET 3		DIET 4	
Separated milk	175 mils.	Separated milk	250–350 mils.
Bread (70 per cent wheaten)	ad lib.	Bread (70 per cent wheaten)	ad lib.
Linseed oil	10 mils.	Linseed oil	5–15 mils.
Yeast	10 gms.	Yeast	5–15 gms.
Salt	½ gm.	Orange juice	3 mils.
		Salt	½ gm.

Table 2.—Diet 1 Plus More Whole Milk

DIET	DURATION, MONTHS	HISTOLOGY RESULTS
Diet 1	4	Rickets
Diet 1	8	Rickets
Diet 1	7½	Rickets
Diet 1+325 mils milk	5	Normal
Diet 1+325 mils milk	5	Normal

Table 3.—Diet 2 Plus Meat and Meat Extractives

DIET	DURATION, MONTHS	HISTOLOGY RESULTS
Diet 2	4	Rickets
Diet 2+dog biscuit	5½	Rickets
Diet 2+dog biscuit	5½	Rickets
Diet 2+water extract of meat	4	Normal
Diet 2+meat protein	5	Rickets
Diet 2+80 per cent alcoholic extract of meat	5	Normal
Diet 2+10 gms. meat	5½	Normal

Table 4.—Diet 2 Plus Yeast and Malt Extract

DIET	DURATION, MONTHS	HISTOLOGY RESULTS
Diet 2	5½	Rickets
Diet 2+10–20 gms. yeast	5½	Rickets
Diet 2+10–20 gms. yeast	5½	Rickets
Diet 2+malt extract	4	Normal
Diet 2+malt extract	7	Slight rickets

Table 5.—Diet 2 Plus Different Fats

DIET	DURATION, MONTHS	HISTOLOGY RESULTS
Diet 2	4	Rickets
Diet 2+10–20 gms. butter	6	Normal
Diet 2+10 mils cod-liver oil	9	Normal
Diet 2+10 mils linseed oil	5	Rickets
Diet 2+10 mils linseed oil	5	Rickets
Diet 2+10 mils peanut oil	5½	Normal
Diet 2+water extract of butter	..	Rickets

Table 6.—Diet 3 with Different Fats instead of Linseed Oil

DIET	DURATION	HISTOLOGY RESULTS
Diet 3	3 months	Rickets
Diet 3	3 months	Rickets
Cod-liver oil	17 weeks	Normal
Butter	17 weeks	Normal
Olive oil	17 weeks	Slight rickets
Peanut oil	17 weeks	Slight rickets
Diet 3	17 weeks	Rickets

Table 7.—Diet 3 Plus Meat and Meat Extracts

DIET	DURATION, WEEKS	HISTOLOGY RESULTS
Diet 3+ 5 gm. meat	17	Rickets
Diet 3+20 gm. meat	17	Rickets
Diet 3+50 gm. meat	17	Rickets
Diet 3+water extract of 50 gm.meat	17	Rickets

the ground that there was sufficient orange juice when considered with the rest of the diet. He apparently determined that the antirachitic factor is either the fat-soluble A or something closely related to it. According to his experiments, substances with little or no antirachitic factor were separated milk, bread, meat protein, yeast, linseed oil and hydrogenated fats. Those with well-marked preventive action were cod-liver oil, butter and suet. Those of less marked action were meat, meat extract, malt extract, lard and olive oil. The results seemed to favor the hypothesis that experimental rickets can be prevented by diets containing an abundance of antirachitic factor and that this factor and fat-soluble A have somewhat similar distributions.

While the results of Mellanby appear almost conclusive, Hess and Unger (6), working with children, did not find that milk fat would prevent rickets, and furthermore rickets did not develop in children whose diet was in every way complete with the exception of the fat-soluble vitamin. They concluded from

their work that the fat-soluble vitamin is not the etiological factor and that infants develop rickets while receiving a full amount of this factor and do not manifest signs of the disease when deprived of this vitamin for long periods.

So much for the cause of rickets. With the exception of the fat-soluble vitamin theory of Mellanby, almost nothing has been determined since Glisson's first article appeared nearly three hundred years ago.

During the past few years a great deal has been done in the investigation of the so-called deficiency diseases. While little discovery has been made in veterinary medicine, considerable has been accomplished in the study of antiscorbutics in man. In this study it was found that the results obtained upon experimental animals, especially the guinea-pig, coincided in almost every particular with those obtained in the human species, except that in the guinea-pig, scurvy occurs in a more acute form.

Accepting this fact, is it not possible that we may have both diseases in young animals where we have commonly recognized but one?

There seem to be at least two forms of rickets in animals. In one there is a fairly good condition of nutrition, softening and bending of the bones, beading of the ribs, enlargements of the joints, weakness of muscles and ligaments, with little or no pain. The animals simply appear unable to support their weight or move. In the other form the animals are in poor condition, the bones near the joints enlarged, ribs beaded, and evidence of stiffness and indications of severe pain on being handled or compelled to move. The pain is explained by some as due to aching of the bones and by others to the distortions together with stretching of the muscles and ligaments. This leads one to wonder why some animals suffer severe pain and others as badly deformed apparently do not.

If we can accept the conclusions drawn as a result of work done upon children, we will find several facts that at least point out the similarity of some of our cases of rickets to acute rickets of children or infantile scurvy.

The swellings of the ends of the bones are common in both rickets and scurvy. Hess and Unger point out that beading of the ribs and slight costochondral hemorrhage may occur in experimental scurvy of dogs. Holt, discussing diagnosis, states

that "acute tenderness should always suggest scurvy rather than rickets. Pain and tenderness are rare in rickets." The therapeutic test is also used as an aid in diagnosis. If the disease is scurvy, the symptoms disappear rapidly as appropriate treatment is begun, while in rickets the improvement is always slow.

So far as I have been able to determine, there are practically no data to show that the deficiency diseases are common in animals, although it would seem that with the numerous methods of feeding young animals we would expect to find some conditions due to faulty feeding.

Haring has recently reported a deficiency disease among poultry in California apparently due to lack of green food. Miller's or bran disease of horses was also due to a lack of some factor. The fact that a change of diet has always been emphasized in the treatment of rickets suggests that there is opportunity for investigation along these lines.

TREATMENT

In a disease in which there is so much doubt as to the cause no routine treatment can be outlined. No case should be treated until a close history of the diet has been obtained. Some change in the food is usually advisable. If the experiments of Mellanby mean anything, young animals should be allowed considerable milk or fat. In carnivora the addition of meat with fat, preferably raw, milk and bones may be tried. Pigs should be given more milk, fat of some source and green stuff. Tankage and mineral matter added to their rations often works well. Young herbivorous animals should be allowed milk or at least a generous diet of grain and hay or preferably green food.

It is difficult to estimate the value of drugs in such a disease, because rickets tends to improve with changes in the diet without any medication. Calcium salts, cod-liver oil and phosphorus have been recommended. It is doubtful if the administration of lime salts has any value, since practically all that are administered pass out with the feces without undergoing absorption. Those most frequently recommended were chalk, precipitated calcium carbonate, calcium lactophosphate and calcium phosphate.

Cod-liver oil is recommended very highly in human medicine and has proven useful to us in treating dogs and pigs. The dose for puppies varies from 1 to 2 or 3 teaspoonfuls daily; for

pigs, about a tablespoonful daily. Osler believes that any other fat will do as well, provided it is digested, but it does not seem that we have been so successful with cottonseed oil. Unfortunately we have always administered phosphorus in the oil, so can not determine which was of more benefit.

Phosphorus has been recommended very highly in Germany but has not been considered so generally successful in other countries. It is supposed that this drug assists or stimulates the deposition of lime salts in the bones. The doses usually recommended are: For foals and calves, 1/5 to 1 grain daily in 1 to 3 ounces of cod-liver oil; for pigs, 1/30 to 1/12 grain daily in ½ to 1 ounce of cod-liver oil; for dogs 1/65 to 1/30 grain in 1 to 4 drams of the oil daily. Friedberger and Fröhner recommend phosphorus 4 to 8 grains, cod-liver oil 10 ounces, tablespoonful daily for colts, teaspoonful for puppies. We have used with satisfaction phosphorated oil, N.F., 1 dram, cod-liver oil 10 ounces, which is about the same as the foregoing prescription but more easily prepared. Our doses have been 1 to 2 teaspoonfuls daily for puppies, 1 to 4 teaspoonfuls for pigs. Just how valuable phosphorus is in the treatment of rickets is not easy to determine because it has been invariably recommended in combination with oil, mostly cod-liver oil.

Treatment of deformities.—In puppies in which the disease has appeared and there is bowing of the legs following exertion, exercise should be limited until the bones have begun to harden and the muscles and ligaments strengthened. This of course does not mean no exercise, but an amount that stops short of producing the deformity. Friction and massage will aid in overcoming muscular weakness. There is some controversy about the use of bandages. If there is extreme distortion, bandages may be applied for a short time to prevent permanent deformity, but should be removed frequently to allow massage and left off as soon as the animals have sufficient strength to hold their legs in an approximately normal position.

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ETHICS

A member from Colorado sent in a clipping from a commercial journal showing lantern slides dealing with hog cholera and carrying the name of a veterinarian. These slides were intended to be exhibited to the laity. The member asked if this conformed to the code of ethics of the A. V. M. A. The matter was referred to the Chairman of the Executive Board and the opinion expressed that it is not permissible, as it does not conform to Section 5., Article 19 of the Code of Ethics which reads: "Advertising specific medicines, specific plans of treatment, or advertising through the medium of posters, illustrated stationery, newspaper cuts, etc., will not be countenanced by this Association."

A recent despatch from South America reports an outbreak of rinderpest near Sao Paulo, Brazil.

Dr. A. O. Bernhardt has given up his practice at New Lisbon, Wis., and has entered into partnership with Dr. R. S. Heer of Platteville, Wis.

Through the courtesy of Dr. Cassius Way a coterie of prominent veterinarians from distant points was shown New York City by moonlight a few weeks ago. It was quite an innovation for men from rural districts, like C. E. Cotton, T. E. Munce, M. Jacob and J. H. McNeil to witness the scenes of "Gay Paree" transplanted on Broadway and at Les Beaux Arts.

STUDIES ON THE CHICKEN NEMATODE, HETERAKIS PAPILLOSA BLOCH [1]

By WILLIAM A. RILEY AND LYLE G. JAMES

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IN SPITE of the considerable amount of work which has been done upon the life history of the ascarid worms, but little is known concerning the development of the common parasite of chickens, *Heterakis papillosa* Bloch. This is the more noteworthy because this nematode is one of the commonest and most readily available of the group.

To be sure, it is usually stated that the roundworms of poultry develop directly, without the necessity for an intermediate host. However, Ackert, 1917, has reported the transmission of *Heterakis papillosa* by feeding earthworms (*Helodrilus gieseleri hempeli* Smith) which were taken from a poultry yard in which the fowls were heavily infested with the parasite. He verified the possibility of direct infection, but states that "the evidence is not such as to preclude the possibility that this earthworm, *Helodrilus gieseleri hempeli*, may in some way serve as an intermediate host of *Heterakis papillosa*."

An oft-quoted "authority" on diseases of fowls evades the question by saying: "We hardly know what is the cause of worms, although we are inclined to believe that overfeeding fowls with dry and musty grain has much to do with it."

However, it is not because we believed that the fact of direct infection was insecurely established, but because of the recent surprising work of Stewart and of Ransom on the migrations undergone by the larvæ of *Ascaris lumbricoides* that we undertook a more detailed study of the development of *Heterakis papillosa* and incidentally of *Belascaris cati* and *Ascaris lumbricoides*.

SYNONOMY

Heterakis papillosa (Bloch, 1782) is more commonly known in the literature as *Heterakis vesicularis* (Fröhlich, 1791). This latter name was accepted by Dujardin, who has been generally

[1] Published with the aproval of the Director as Paper No. 218 of the Journal Series of the Minnesota Experiment Station.

followed. The question has been further complicated by the fact that Molin in 1860 applied the specific name *papillosa* to another species of *Heterakis,* found in *Corvus cajanus.* However, according to the rules of zoological nomenclature, Molin's species was necessarily renamed. The synonomy of the species with which we are concerned has been worked out very carefully by Railliet and Lucet, 1892, who have established the correctness of the specific name *papillosa* for it.

DISTINGUISHING CHARACTERISTICS.

There are eight species of ascarid worms reported for chickens. Of these, two species, *Heterakis papillosa* and *Ascaridia perspicillum,* are the ones commonly met with in this country.

Heterakis papillosa is the smallest of the ascarid parasites occurring in fowls, male specimens measuring 7-13 mm. and females 10-15 mm. in length. The three lips surrounding the mouth are small and similar in size. The spicules of the male are very unequal in length.

The most common related species found in our poultry is *Ascarida perspicillum* (Rudolphi, 1803), formerly known as a species of *Heterakis.* It is distinguished by the fact that the lips are of unequal size, the upper being the largest. The spicules of the male are approximately equal. The worms of this species are very much larger than the preceding, the males measuring 3-8 cm. in length, the females 6-12 cm.

Heterakis papillosa is not only a parasite of chickens but has been reported also for the turkey, guinea-fowl, pheasant, peacock, duck and goose.

PREVALENCE OF HETERAKIS PAPILLOSA

Heterakis papillosa occurs most frequently in the ceca of chickens, although it is not uncommon to find it in the large intestine.

In our examinations we have found it present in 50 out of 64 chickens from the College poultry plant, the percentage of infestation for these yards being thus 78.1. Out of an additional 273 from various localities, secured on the market, 162, or 59.1 per cent, were found to be infested. The total showed, therefore, an infestation of 62.9 per cent.

Ackert, 1917, working at Manhattan, Kansas, reports that out

of 395 chickens taken locally, 293, or 74.1 per cent, were infested with *Heterakis papillosa*. Dujardin, at Rennes, France, found it in 107 out of 190 fowls examined, or 56.8 per cent. On the other hand, Roth, 1903, in the course of studies at Breslau, Germany, found the species in but 13 out of 230 chickens examined.

As for degree of infestation, we found variations from 3 to 113 in the local fowls examined. Ackert reports an average infestation of 34.4, "but a single infection of 100 nematodes is not uncommon and in one instance a fowl contained 326 of these parasites." Rarely they occur in the ceca in such numbers as to obstruct the lumen, and it has been reported that in certain cases the embryos, instead of remaining free in the cavity, perforate the mucosa of the ceca and lodge in its walls (Neveu-Lemaire).

DEVELOPMENT OF HETERAKIS PAPILLOSA

Leuckart was the first to publish any definite observations on the life history of *Heterakis papillosa*. In the second volume of "Die menschlichen Parasiten," 1876, page 131, he reports finding numerous worms in the ceca of a half-grown chicken which had been fed five days previously on eggs containing embryos. On the basis of this experiment he regarded it as probable that the development was direct. The eggs used had been developing for several months (February to June).

Railliet and Lucet, 1892, repeated this experiment. Eggs removed from the uterus of *H. papillosa* were incubated from the 24th of November until the 26th of the following February. They were then fed to a chicken which previously had been shown by feces examination to be free from helminths. A few days later the bird suffered from diarrhea. Thirty-one days later it was killed and 15 specimens of *H. papillosa* were found in the ceca.

The detailed experiments and the conclusions of Ercolani, 1873, relative to the life cycle of *Heterakis* need be only mentioned. Misled by invading, free-living forms, he maintained that the eggs of *H. papillosa* and of *Ascaridia perspicillum* develop into rhabditiform worms in the excrement. His feeding experiments were without results, but did not shake his belief that the heterogony exhibited by *Angiostoma nigrovenosum* of the frog is a widespread phenomenon among parasitic nematodes.

Based primarily upon the work of Leuckart and of Railliet and Lucet, present-day writers uniformly state that the development of these roundworms of poultry is direct, and it may seem superfluous to reexamine the evidence.

However, as already stated, the recent work upon the development of *Ascaris*, a form usually cited as typical of a simple, direct development, opens up an entirely new side to the problem. This work is so fully discussed by Ransom and Foster, 1920, that it need not be discussed in detail. Briefly, Stewart, 1916-1918, found that if a mouse or a rat be fed eggs of *Ascaris lumbricoides*, the larvæ which escape in the intestines wander out of the intestines into the liver and later into the lungs, where they undergo development and finally migrate back to the intestines. In the lungs they may cause a serious pneumonia, which may prove fatal. Stewart suggested that the development of *Ascaris* in man and in pigs was not direct, but that rats and mice act as intermediate hosts in the life cycle, the larvæ passing out with the feces and contaminating food, through which they reach their final host.

The work of Stewart has been fully confirmed and extended by Ransom and Foster, 1917, 1919, 1920. We have repeated this work and have devoted especial attention to the development of *Belascaris cati*, the common roundworm of the cat, which we find to undergo the same cycle of developments. Ransom and Foster have shown, however, that Stewart's hypothesis as to rats and mice acting as intermediate hosts is untenable. The development of *Ascaris* takes place without the necessity for a second host, and the discharge of larvæ from experimental rats and mice is "simply the expression of an abortive development in animals imperfectly adapted as hosts."

In the light of these discoveries on the life history and pathologic significance of one of our commonest parasites, the question naturally arises as to whether the related ascarid worms of fowls have a similar cycle and may cause losses of young chickens in a hitherto unsuspected manner.

The mature worms of *Heterakis papillosa* are not commonly discharged from the host, but the eggs are passed in great numbers with the feces. As discharged from the host, the eggs are in an unsegmented condition. Their subsequent development, as in the case of other parasites, is intimately dependent upon the

conditions to which they are exposed. Freshly discharged eggs are incapable of development in a new host. Obviously, then, the implication of some of the general poultry texts, that infection may be contracted by the swallowing of recently dropped worms by other chicks, is without foundation.

Under what might be regarded as normal summer conditions of development in this region, segmentation of eggs in water begins immediately, reaching the morula stage in 4 or 5 days. The rate of development of eggs of the same lot is far from uniform, coiled embryos being visible in some while yet others are in the early segmentation stages. Motile embryos are present in large numbers by the ninth to the eleventh day. It is in this stage that the eggs are infective. The early developmental stages proceed much more rapidly in a dry medium, but the embryos will not attain their full development except in the presence of moisture. Dry cultures which had attained the coiled embryo stage remained latent for 6 weeks, and promptly became motile on the addition of moisture.

Eggs in the motile embryo stage were fed to incubator chicks which had been protected from any possibility of accidental infection. Within 4½ hours emerged larvæ were to be found in the small intestine. At the end of 24 hours they were present in numbers in the ceca. At this time they measure 250 microns in length to 18 microns in maximum width. The distance from the anal opening to the tip was 5 microns. By the tenth day the larvæ in the ceca had increased greatly in length, measuring 790 microns with a maximum width of 45 microns. The length of the tail at this stage was 33 microns. The alimentary canal was conspicuous and the gonads were clearly outlined. Complete development was attained by the twenty-fourth day.

Throughout the whole course of this work especial attention was devoted to the question as to whether the larvæ of *Heterakis papillosa* undergo any migration comparable with that of *Ascaris* in the course of their development. Samples of blood were treated with 2 per cent acetic acid, centrifuged, and the precipitate diligently searched. In no case were larvæ found. The liver and lungs were separately brayed in a mortar with physiological salt solution, thoroughly washed, strained and centrifuged. No larvæ were to be found. It can thus be said with confidence that the larvæ of *Heterakis papillosa* do not in the course of

their development undergo migrations such as these which have been found to occur in the case of *Ascaris lumbricoides* and *Belascaris cati*. Their development is simple and direct.

THE RESISTENCE OF EGGS OF HETERAKIS TO COLD

While the fact that the eggs of certain nematodes are very resistant to changes of temperature is known, the extent to which this is true is not so well recognized. In fact, we have been assured by various persons that parasites were comparatively insignificant in Minnesota because the winters are so severe. In view of this, the following data on the effects of cold storage on the eggs of *Heterakis papillosa* are significant. As will be seen from the following synopsis of the treatment to which poultry are subjected in the large commercial plants, parasitic material which has been in cold storage for some time should be in considerable degree comparable with that which has passed through a hard winter in the open.

After killing, the birds are picked, leaving the head, legs and entrails intact. They are then passed to a chilling room where they remain for 24 hours subjected to a temperature of 34° F. At the end of this period they are transferred to a "sharp freezer" for three days at a temperature of 0° F. to —10° F. On the fifth day, they are placed in boxes and packed in the storage vaults where the temperature is maintained at 0° F. to 10° F. Here they remain until they are placed in the hands of the wholesaler. Birds which had been killed on October 3 and removed from the vaults the following April 1 were examined. Although they were frozen solid by the temperature to which they had been exposed for six months, a number of specimens of *Heterakis papillosa* were removed from the ceca when they were thawed out. In these worms the eggs were unsegmented, as in freshly killed specimens.

Eggs removed from these worms were cultured in 0.2 per cent HCl. On the fifth day 50 per cent of the eggs were in advanced stages of segmentation. Some were in earlier stages and a small percentage showed signs of degeneration. By the seventh day many contained moving embryos, and by the eighth day these were beginning to elongate and uncoil in the normal manner. Twenty-five per cent of the eggs appeared to be degenerating.

The results clearly showed that the eggs subjected to a long

period of freezing were capable of developing to the infective stage in practically a normal period. It would appear, however, that the low temperatures maintained for prolonged periods affected injuriously a number of the eggs.

EFECT OF HETERAKIS PAPILLOSA ON THE HOST.

The literature of poultry husbandry abounds in loose statements regarding the symptoms of internal parasitism. In reality, the clinical symptoms of worm infestation are notoriously vague. Only in comparatively few instances can they be depended upon, and certainly the typical *Heterakis* infestation is not readily recognizable except by postmortem or by microscopic examination of feces.

A frequently mentioned symptom is diarrhea, and there is no doubt that this condition may be caused by heavy infestation with *Heterakis*. In a number of our experimental birds it was clearly evident, but similar difficulty occurs so commonly in young chicks that its appearance can not be considered an evidence of worm infestation. The ceca of experimentally infested chicks showed marked inflammation, and even in the older birds heavy infestation was characterized by inflammation and thickening of the walls of the ceca.

Galli-Valerio, 1897, reported the occurrence in a pheasant of cecal tumors caused by the larvæ of *Heterakis papillosa*. This condition has been discussed in detail by Letulle and Maratel, 1908. The walls of the ceca were infiltrated with numerous whitish or cream-colored nodules of a globular or ellipsoid form, whose caliber varied from the size of the head of a pin to that of a pea. Their thickness was often greater than that of the walls of the ceca. Most frequently they were not isolated but grouped three, four or five together, forming thus conglomerates of which the volume was at times considerable. Within each of these nodules there was imbedded a little cylindrical worm, measuring 1.5 to 4 mm. in length by 100 to 325 microns in width. These worms proved to be the larvæ of *Heterakis papillosa*. In both birds studied the invasion was the cause of death.

We have not seen anything comparable to this condition in the cases we have studied. Nevertheless one can not observe flocks infested with *Heterakis papillosa* without becoming convinced

that, however vague the symptoms, the worms are a cause of unthrifty condition and a source of loss to the poultryman. When as a result of crowding of the birds or favorable seasonal conditions the infestation becomes heavy, the losses may be direct and serious.

REMEDIAL AND CONTROL MEASURES

No remedial treatment has been devised which can be said to be satisfactory for controlling *Heterakis papillosa*. While our own experiments along this line have not been extended, they have convinced us that the commonly recommended drugs are of little real efficacy.

Chickens subjected to the tobacco treatment recommended by Herms and Beach, 1916, were found on postmortem to show the average infestation for the flock. There was no evidence that the treatment had removed any of the parasites.

Hall and Foster, 1918, obtained slight results. Experimenting with 6 chickens, the treatment removed 30 out of 162 *Heterakis papillosa*, or 19 per cent of the total present in the 6 subjects. Of course such results are wholly negligible as a method of eradicating infestation from a flock. Even if the treatment could be depended upon to remove about one-fifth of the worms present, the eggs scattered by the remaining worms would keep up the infestation without abatement. It should be granted, as pointed out by Hall and Foster, that in view of the difficulty of removing *H. papillosa* from the ceca it is quite possible that the treatment would be effective in removing *Ascaridia perspicillum* from the small intestine, especially if the dose is repeated, as recommended by Herms and Beach.

Next to a desire for some medical treatment which will effectively combat parasitic infestation, the practical poultryman wants to know of some chemical which when sprinkled on the ground will destroy the eggs of the parasite and render the yards safe. Of the many such chemicals recommended, the vast majority have been already shown to be useless. The most constantly recurring recommendation along this line in reputable texts is "disinfection" by watering the ground with 1 per cent solution of sulphuric acid. Our experiments have shown that the eggs placed directly in and kept in such a solution may be readily developed to the infective stage. Even if the sulphuric acid killed the eggs immersed in it, the sprinkling of the ground

or even the puddling of it with the chemical would be of very doubtful value.

More recently Herms and Beach, 1916, have recommended disinfection by the use of 1 to 1,000 solution of bichlorid of mercury. They base their recommendation on the following experiment: Two brooder yards in which had been kept fowls heavily infested with *Ascaris inflexa* (**Ascaridia perspicillum*) were selected. Microscopic examination of the soil from these yards revealed the presence of large numbers of roundworm eggs to a depth of 2 inches below the surface. No eggs could be demonstrated in soil removed from a greater depth. One of these yards was untreated. From the other all of the filth and loose surface dirt was swept up and hauled away. The yard was then sprinkled with a 1 to 1,000 solution of bichlorid of mercury. It was found that at least 1 gallon of the disinfectant for every 10 square feet of ground was necessary to penetrate the soil to a sufficient depth, namely, 2 inches. In addition the house connected with the yard was also thoroughly cleaned and disinfected as above, and fitted with roosts beneath which a wire netting was placed so as to exclude fowls from the droppings. After treating about 50 badly infested scrub fowls with tobacco and finding them free from worms by postmortem examination of certain individuals, and assuming the rest to be so, they were divided into two equal lots, one placed in the yard treated with bichlorid of mercury and the other in the untreated yard. The birds in the treated yard increased in size rapidly, while those in the untreated yard showed no material improvement in condition nor increase in size. At the end of three weeks certain of the poorest looking birds in the treated lot were examined by postmortem examination and found to be absolutely free from roundworms, while a similar examination of birds from the untreated yards showed in their intestines many roundworms in all stages of development.

But relative to the effects of the bichlorid of mercury, our experiments have shown that the eggs of the worm can be reared to the infective stage with the utmost ease in a 1 to 1,000 solution. This is true not only of the eggs of *Heterakis papillosa* but of those of *Ascaridia perspicillum*. The outcome of the experiment of Herms and Beach, above outlined, was due to the thorough cleaning which they gave to the yard and house in the one case, and the lack of any such treatment in the second.

Trouble from *Heterakis papillosa* and from other internal parasites of poultry is best avoided by the selection of clean, dry runs and well lighted houses, kept thoroughly clean. The grounds should be changed every two or three years. Where this is impossible they should be deeply spaded or ploughed so that the entire surface soil may be turned under. This will not obviate the possibility of parasitic infestation but will very greatly reduce it.

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"The stamping mill at the Ohio penitentiary has finished and delivered a million dog license tags for 1921 and they are being placed in the hands of the county auditors. That is a rough estimate of the number of dogs in the State."—*Ohio Farmer.*

A BACTERIOLOGICAL STUDY OF ABSCESS OF THE FEET OF HENS

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IT IS OBSERVED that in flocks of heavy laying hens, and especially those of the more delicate breeds, as the Leghorns, abscess of the soft structures of the soles of the feet occur especially in late summer and fall.

The bacteria most commonly found in boils, abscesses, carbuncles and similar suppurative processes in man belong to the group of staphylococci (1). The presence of staphylococci was first shown by Pasteur (2) in 1880 and later by Ogston (3) in 1881. The relation of staphylococci to the suppuration of wounds and to osteomyelitis was first clearly brought out by the work of Rosenbauch (4) in 1884. Several races or strains of staphylococci have been differentiated in the course of later investigations. One of these, *Staphylococcus pyogenes aureus,* is found frequently in connection with pathologic processes in man. The other varieties, though very similar, differ in slight particulars from this type.

The cells of *Staphylococcus aureus* are generally aggregated in loose, irregular masses which have been likened to clusters of grapes and have been given the generic name of the organism. The dimensions of the individual cocci vary within rather narrow limits, the diameter of the cells ranging between 0.7 and 0.9 micron. The ordinary aniline dyes stain the cells readily; no decolorization occurs with Gram's method. Considerable resistance is displayed toward drying, experiments showing a retention of vitality for many days and even months. The organism is found relatively infrequently in nature except in association with the animal body and in the air of hospitals, stables and similar situations where its presence is readily explicable. It produces a golden pigment which is probably a lipochrome, a specific gelatinase, and other enzymes such as rennin, maltase, staphylolysin and leucocidin.

The writer has isolated *Staphylococcus pyogenes aureus* from sore lips in sheep, wounds of dogs, abscess of horses, and from abscess of cattle and hogs.

Bacterins on the market prepared from the various strains of staphylococci are giving good results in the treatment of infections in animals caused by similar organisms. The production of active immunity is accompanied by a striking development of phagocytic action. Such increased phagocytosis has been shown by Wright (5) and others to be connected with the formation of bacteriotropic substances or opsinins in the blood of immunized animals.

That the domestic fowl has great resistance to certain common pus-producing organisms is shown by the fact that to one young cockerel of 3 pounds weight there was given 29 c.c. of a three-day-old bouillon culture of *Staphylococcus pyogenes aureus* and *Staphylococcus pyogenes albus* with no noticeable ill effects (6). The *aureus* was originally isolated from a furuncle of human origin and had been passed through two rabbits, producing septicemia in each case. The *albus* was isolated from an abscess of a horse and likewise was passed through two rabbits, causing septicemia in each case. Subsequently two hens were given 10 c.c. each of a three-day-old bouillon culture of the same organisms without any noticeable ill effect. The great resistance is also shown by the way fowls uniformly stand up under repeated intraperitoneal injections of bouillon cultures of these organisms.

A report of a case of infection of the shank of a Single Comb Rhode Island Red cock due to *Staphylococcus pyogenes aureus* was made from this laboratory in 1919 (7).

THE PROBLEM

Abscess of the soft structures of the soles of the feet of heavy laying hens is observed in the latter part of summer and early fall. This condition is observed to be more prevalent among the more delicate breeds, as the Leghorns.

The plan decided upon is to select several typical hens from the laying flocks and by laboratory methods make an effort to determine if the cause is bacterial and if so to make an effort to identify the organism.

CASE REPORTS

Case No. 1

History.—A Single Comb White Leghorn hen, No. A-165, a member of pen 25 of the North Carolina Experiment Station. This hen was hatched May 28, 1918, began to lay January 5,

1919, and laid 122 eggs in her pullet year. In her second year she began to lay November 19, 1919, and laid 131 eggs up to September 1, 1920. In her second year she went broody June 17 and lost 16 days' time in laying. She again went broody July 22 and lost 15 days' time in laying. During the latter part of June and early July she developed an abscess of the soft structures of the sole of the foot and was sent to the laboratory July 9 for operation.

Clinical Study.—An abscess had developed in the soft structures of the sole of the left foot. The bird was lame; in fact, could not support her weight upon the affected leg. The surface of the abscess on the sole of the foot was sterilized with pure alcohol and an incision was made with a sharp-pointed bistoury. The bistoury was rendered sterile by dipping in alcohol and

An abscess of the soft structures of the foot of a Single Comb White Leghorn hen.

burning off the alcohol. A platinum needle was then used in inoculating tubes of 1 per cent glucose-agar. Pure cultures were obtained in all tubes of an organism to be described alter.

Case No. 2

History.—A Single Comb White Leghorn hen, No. A-166, from the same pen as case No. 1. This hen was hatched May 28, 1918, and laid her first egg November 18, 1918. She laid 183 eggs in her pullet year, and began her second year's laying December 5, 1919. She laid 13 eggs in June, quit laying on the 17th, went broody on the 18th and was placed in the broody coop. She was released from the broody coop on the 25th. She began to lay July 8 and laid again on the 9th, at which time she was sent to the laboratory for operation.

Clinical Study.—An abscess was observed in the left foot similar to that described in case No. 1. Similar inoculations were made as in case No. 1. Pure cultures were obtained of an organism to be described later.

Case No. 3

History.—A Single Comb White Leghorn hen, No. A-135, from the same pen as case No. 1. This hen was hatched March 16, 1918, and laid her first egg December 3, 1918. She laid 114 eggs in her pullet year. She began to lay in her second year February 9, 1919. She laid 14 eggs in June, and also laid on the 2d, 3d and 4th of July and then went broody. Both feet showed evidence of abscess condition and she was sent to the laboratory for operation July 10.

Clinical Study.—Abscess of both feet is observed. The bird finds considerable difficulty in getting about owing to the pain caused by trying to walk. Inoculations of culture medium were made as in the other cases. Pure cultures were obtained of an organism to be described later.

Case No. 4

History.—A Single Comb White Leghorn hen, No. A-168, from pen 34 of the North Carolina Experiment Station. These birds were hatched in March, 1919, and reared till they were five months old, at the Manitoba Agricultural College, Winnipeg, Canada. This hen was from a pen of birds that were in a coöperative experiment between the Poultry Department of the abovementioned institution and the Poultry Department of the North Carolina Experiment Station at West Raleigh, N. C. This hen was in her pullet year and began to lay November 13, 1919. She laid 15 eggs in June and on the 4th, 6th, 9th and 10th of July. She was sent to the laboratory July 10 for operation.

Clinical Study.—An abscess of the right foot is observed. The bird is lame and finds considerable difficulty in getting around. Inoculations of culture medium are made as in the preceding cases. Pure cultures were obtained of an organism to be described later.

Case No. 5

History.—Single Comb White Leghorn hen of the same pen as case No. 4. This hen laid 15 eggs in June and also laid on the 2d, 4th, 6th, 8th, 9th and 11th of July. She was sent to the laboratory July 11 for operation.

Clinical Study.—A slow-developing abscess was observed involving the soft structures of the sole of the left foot. The bird stands holding its left foot in the air. Walking, using the left foot, is quite painful. Inoculations of culture medium are made as in the preceding cases. Pure cultures were obtained of an organism to be described later.

Case No. 6

History.—A Single Comb White Leghorn hen of the same pen as case No. 5. This hen laid 15 eggs in June and laid the 1st, 3d,

6th, 8th and 11th of July. She was sent to the laboratory for operation July 11.

Clinical Study.—There is an abscess of the right foot. The bird is unable to walk without considerable pain. Culture medium is inoculated as in the previous cases and a pure culture obtained of an organism to be described later.

Operation and Treatment.—After cleaning the surface of the abscess, in each case, with antiseptic, an incision was made directly into the abscess. In each case ths pus was found to be of a cheesy nature. The pus is curetted out and the wound swabbed out with pure iodine. A pledget of cotton soaked with iodine is left in the wound and the birds returned to the respective pens. Recovery in all cases was rapid.

A STUDY OF THE ORGANISM

In all cases a pure culture of a similar organism was obtained. The following are the characteristics of this organism:

Character of the Organism.—A coccus. There is a tendency for the cocci to be in clusters in smears from liquids.

Flagella, absent.

Capsule, absent.

Growth at 37° C., abundant.

Staining reactions, readily with ordinary aniline dyes as fuchsin, methylene blue, gentian violet, and Loeffler's methylene blue.

Reaction to Gram stain, positive.

Cultural Features.—Agar plate, growth, the colonies at the end of 24 hours are smooth with slight tendency toward a dirty yellow or old gold color. At the end of 48 hours the colonies are orange color. At the end of 24 hours the colonies vary in size up to 1 mm. in diameter. There is no tendency for the colonies to spread and cover the surface of the medium. The edge of the colony is smooth and opaque in color. It is finely granular. The colony has a slightly raised surface.

Agar stroke, 24 hours, abundant growth, elevated, and orange with echinulate edge.

Potato, 24 hours, abundant growth. No tendency to spread. Color, orange yellow.

Gelatin stab.—Cup-shaped liquefaction at the end of seven days. At the apex of the liquefaction there is collected an orange-yellow precipitate.

Nutrient broth, 24 hours, diffused cloudiness. Tendency, as culture becomes older, to orange-yellow flocculent surface growth with ring on glass. This surface growth at no time becomes abundant. Tendency to orange-yellow precipitate in the bottom of the tube.

Milk.—Solid coagulation in all tubes at the end of 48 hours. Little or no tendency to digestion.

Blood serum.—Abundant growth without digestion of the blood serum.

Glycerin bouillon.—Uniform cloudiness with tendency to flocculi on surface and ring where surface of medium comes in contact with the glass tube.

Bouillon under oil, 24 hours, slight growth; 72 hours, moderate growth. Growth confined to upper third of the medium.

Bouillon over chloroform, 24 hours, slight growth in upper third; 72 hours, moderate growth in upper third of medium.

Diastatic action, absent.

Thermal death point.—Time of exposure in water bath, 10 minutes:

TEMPERATURE, C.	24 HOURS	48 HOURS	72 HOURS	96 HOURS	7 DAYS
Control	+	+	+	+	+
56	+	+	+	+	+
58	+	+	+	+	+
60	−	+	+	+	+
62	−	−	−	−	−
64	−	−	−	−	−

The exposure of 60 C. arrested growth, and 62 C. killed the organisms.

Test Against Phenol.—Exposure 10 minutes in each dilution:

PERCENTAGE IN TUBE	24 HOURS	48 HOURS	72 HOURS	96 HOURS	7 DAYS
Control	+	+	+	+	+
0.1	+	+	+	+	+
0.25	−	+	+	+	+
0.5	−	−	−	−	−
0.75	−	−	−	−	−
1.0	−	−	−	−	−
2.0	−	−	−	−	−
3.0	−	−	−	−	−
4.0	−	−	−	−	−
5.0	−	−	−	−	−

Phenol, 0.25 per cent, arrested growth, and 0.5 per cent killed the organisms.

Toleration to acid, Fuller's scale:

ACID	24 HOURS	48 HOURS	72 HOURS	7 DAYS
10[1]	+	+	+	+
20	–	–	–	–
30	–	–	–	–
40	–	–	–	–

[1]Control tube.

There was no growth in any of the tubes. The control showed abundant growth.

Toleration to NaOH, Fuller's scale:

NaOH	24 HOURS	48 HOURS	72 HOURS	7 DAYS
10[1]	+	+	+	+
0	+	+	+	+
10	+	+	+	+
20	–	–	+	+
30	–	–	–	–
40	–	–	–	–
50	–	–	–	–
60	–	–	–	–

[1] Control tube.

Plus 20 arrested growth, and 30 killed the organisms.

Below is given the results of the action of this organism on 11 different sugars; all fermentation tubes containing 1 per cent of the sugar; titrations made at the end of 7 days.

Monosaccharides:

Hexoses: Dextrose, +++
Mannose, +++
Galactose, ++

Pentose: Xylose, ±

Disaccharides:

Lactose, ++
Maltose, ++
Saccharose, +++

Trisaccharide:

Raffinose, ±

Polysaccharide:

Dextrin, ±

Polyvalent Alcohol:

Mannite, ++

Glucoside:

Salicin, +++

There was no change in the xylose, raffinose or dextrin. There was moderate acid formation in the galactose, mannose and mannite. There was strong acid formation in dextrose, mannose, saccharose and salicin. Where acid was formed in one sugar of a group it is noted that it was formed in all the sugars of that group. There was no gas formation in any of the tubes.

Pathogenicity.—Inoculation No. 1 was made subcutaneously into a half-grown rabbit, using 4 c.c. of a 48-hour broth culture from case No. 1. Abscess formed at the point of inoculation. The organism was reisolated from the pus of the abscess.

Inoculation No. 2 was made subcutaneously into a half-grown rabbit, using 4 c.c. of a 48-hour broth culture from case No. 3. Abscess formed at the point of inoculation. The organism was reisolated from the pus of the abscess.

Inoculation No. 3 was made into the soft structures of the left foot of a Barred Plymouth Rock hen, using 2 c.c. of an emulsion made from a glucose-agar slant. The culture was washed off of the slant, using physiological salt solution. At the end of 24 hours the bird was lame, the foot swollen, hot to the touch, red, and painful upon palpation. In the course of a week the acute inflammation subsided.

Inoculation No. 4 was made into the soft structures of the right foot of a Mottled Ancona hen, using 3 c.c. of a 72-hour culture on agar. The culture was washed off with physiological salt solution. At the end of 24 hours there was noted in the inoculated foot heat, painfulness, redness, swelling, the bird holding its foot suspended in the air. In a few days the acute inflammation subsided.

Inoculation No. 5 was made into the soft structures of the left foot of a White Plymouth Rock hen, using 2 c.c. of a 48-hour culture from case No. 5. The culture was grown on nutrient agar and washed off with physiological salt solution. At the end of 24 hours there was noted heat, pain, swelling, and redness at the point of inoculation. The bird limped when walking. After a few days the acute inflammation gradually subsided.

DISCUSSION

In the study of abscess of the feet, of the Single Comb White Leghorn hens, typical of the abscesses found in the after part of the summer and early fall, there has been isolated in pure cultures in all cases the *Staphylococcus pyogenes aureus.*

The organism, inoculated subcutaneously into a rabbit, caused abscess from which the staphylococci were reisolated in pure cultures. Inoculations into the soft structures of the feet of hens caused acute inflammation, which gradually subsided after a few days. Abscess of the feet of birds is usually found in

heavy laying hens and in the after part of the summer when the long months of laying have reduced, to a certain extent, their vitality. It is mostly found in the more delicate breeds, as Leghorns, though abscess of the feet of hens have been observed in the heavier breeds as the Rhode Island Reds. Bruising of the soles of the feet, as jumping from high perch poles to hard floors, favors abscess formation when the pus-producing organisms are present.

In all cases the pus in the abscess is of a cheesy nature.

Lancing the abscess and curetting out the cheezy pus, followed by swabbing out with pure iodine, is followed by recovery in all cases. One inch bandages can easily be applied and the wound dressed once a day.

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RELIEF WORK

Report of the Anglo-American-Franco-Belgian Committee for the Relief of Veterinary Victims of the War held its final meeting in Paris on November 8, 1920, for the purpose of liquidating its operations. The following paragraph extracted from the proceedings will interest Americans:

The Committee has had the pleasure of receiving a check of $500 from the American Veterinary Medical Association as a new contribution from our American friends and confreres to the benevolent work of the committee. At the present rate of exchange this sum netted 7,520 francs, which has permitted the executive commission to distribute eleven complimentary contributions to veterinarians with families to support and which would not have been possible without this new remittance.

The veterinary profession of France and our confreres of Belgium will be grateful for this new manifestation of the cordiality of the American veterinarian.—(From the *Recueil de Médecine Vétérinaire,* December 15, 1920.) L. A. M.

ACTION OF CERTAIN DRUGS ON THE UTERUS[1]

By LOUIS A. KLEIN

Dean, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, Pennsylvania

DRUGS acting on the uterus have not interested the veterinarian very much in the past, because, until recently, his obstetric practice consisted almost entirely of rendering assistance in cases of difficult parturition in the mare and cow and sometimes in the bitch, replacing a prolapsed uterus of the mare or cow, or removing a retained placenta from the cow, and in most of these cases he was able to attain the desired result without the use of drugs. But within the last few years many breeders of cattle have awakened to the losses resulting from sterilty in cows, and the veterinarian has had an opportunity to treat numerous diseases of the reproductive organs which were formerly not brought to his attention. In view of these developments, drugs acting on the uterus, one of the reproductive organs now frequently demanding his attention, should be of greater interest to him than heretofore, not because they can be used in place of the surgical methods which are usually employed, but because it is possible that they may in some cases be employed to supplement and assist these methods.

Certain drugs when given internally start up contractions in the quiescent uterus and increase the force of contractions already under way; others cause the uterine muscle to relax, and some dilate the blood vessels of the uterus as well as those of the other genital organs and cause a hyperemia.

The drugs which cause contraction of the uterus include ergot, pituitary extract, quinine and hydrastis. Arecoline and eserine also stimulate the uterine muscle, but they exert a more pronounced stimulant action on the intestinal muscle. Ergot and pituitary extract stimulate the intestinal muscle, but they act upon the uterine muscle in smaller dose and with greater force.

Ergot, hydrastis, quinine and pituitary extract have been used extensively in human obstetrics to overcome uterine inertia during parturition and to check uterine hemorrhage; but in

[1] Presented at the meeting of the Pennsylvania State Veterinary Medical Association, Harrisburg, Pa., January 25, 1921.

veterinary medicine, if we may judge from the scarcity of reports in the literature, these drugs have been used very little in these conditions in animals. One reason for this may be that when uterine contractions become weak or are suspended in the mare or cow, the fetus can usually be delivered by traction. Since the introduction of pituitary extract a few years ago it has been employed to stimulate the uterus in weak or suspended labor in whelping bitches, and usually with good results if the animal was not exhausted and there was nothing to prevent the passage of the fetus; but few if any reports have been published in the veterinary journals of the use of this preparation as a uterine stimulant for animals of other species. Quinine and hydrastis do not appear to have been used to any extent, if at all, in cases of uterine inertia in animals.

Ergot has been employed to expel the retained placenta of the cow, but in those cases in which the results were closely studied not the slightest contraction of the uterus could be detected, much less a loosening of the membranes. Ergot also failed to cause the uterus to contract when involution did not take place spontaneously following the removal of a retained placenta, although massage of the uterus through the rectum induced contraction in such cases (Pomayer[1]).

Albrecht and Dorn are quoted by Fröhner[2] as authority for the statement that ruminants, and especially cows, react to ergot to only a slight degree. Considering the tendency of ergot to deteriorate, especially in the presence of water, and the fact that when a drug is administered to a ruminant by the mouth a part of the dose passes to the rumen, where it is exposed to maceration and bacterial action for hours or days, it is only natural that ergot should act less efficiently on ruminants than on monogastric animals when given per os. The injection of the active principles of the drug subcutaneouly would be a more certain method of testing its efficiency. Ergotoxine, ergamine or histamine, and tyramine, but principally the first two, have been shown by the researches of Dale and Barger to be responsible for the activity of ergot; but while the physiological action of these principles on experimental animals has been carefully studied, there is no information in the literature re-

[1] Pomayer, C. Das Zurüchkhalten der Nachgeburt beim Rind, p. 57. Richard Schoetz, Berlin, 1908.
[2] Frohner, Eugen. Arzneimittellehre fur Tierarzte, 11th edition, p. 187.

garding their use in the treatment of disease in the domestic animals. The preparation known as ergotine, which has been put out by several pharmaceutical houses for intramuscular injection, is principally a mixture of the water-soluble principles, histamine and tyramine, and contains only a relatively small quantity of the alcohol-soluble ergotoxine. The fluid extract of ergot may also be injected intramuscularly, but, being an alcoholic preparation, it probably contains only the alcohol-soluble principle ergotoxine, while the solid extract, an aqueous preparation, probably owes its activity to the presence of histamine and tyramine. No careful study appears to have been made, however, of the relative efficiency of these preparations in inducing contraction or involution of the uterus following retained placenta or in other pathological conditions affecting the uterus of the domestic animals.

It would seem to be a reasonable expectation that any agent that will cause the uterine muscle to contract would be of assistance in the treatment of chronic endometritis and pyometra of the cow, as the uterine wall is in a flaccid or relaxed condition in these cases, and its contraction should facilitate drainage and improve the circulation. Pituitary extract has been used with satisfactory results in these conditions in women, but there is nothing on record of the use of any of this group of drugs in these conditions in animals. The drug would have to be administered two or three times daily until the uterus was firmly contracted, which would probably require a week or ten days. As these drugs, except ergotine, are all rather costly, the treatment might be too expensive in some cases, but where it can be used it would seem to be worthy of a trial, especially in those cases which do not respond to the usual surgical treatment.

Of the drugs which cause hyperemia of the uterus, yohimbine or quebrachine has the most pronounced action. This is an alkaloid which is obtained from the bark of the yohimbehoa tree (*Corynanthe yohimbi*); it is also present in the U. S. P. preparation aspidosperma (formerly quebracho) and in aspidospermine, which is a mixture of alkaloids and other substances obtained from quebrancho. Yohimbine produces a more or less general dilation of the blood vessels, but it acts most powerfully on the blood vessels of the genital organs, causing a marked hyperemia and stimulating the sexual impulse. This effect is brought about

without any irritation of the urinary organs such as occurs when cantharides is administered. In animal experiments with yohimbine, erection of the penis and swelling of the testicles and epididymis were observed in the males, while in females the Graafian follicles matured rapidly, the horns of the uterus became hyperemic and swollen, the mucous membrane became hyperemic and some bleeding occurred, the vulva was swollen and there was some blood-stained discharge; in short, all the changes which occur in estrum were observed. Both males and females showed pronounced sexual excitement. Yohimbine has been used in the treatment of impotence in bulls and stallions and in cows which failed to come in heat or which were sterile for other reasons. An injection of 1/3 to 3/4 grain of yohimbine hypodermically will bring on symptoms of estrum in 3 to 6 hours and the effect will continue from 30 to 40 hours. Most of the veterinarians who have reported on the use of yohimbine had satisfactory results, conception occurring in 90 per cent of the females treated; but some practitioners have made unfavorable reports. It seems to act most efficiently in males which are apparently healthy and in which no cause for impotence can be found and in females which do not come in heat. The hyperemia of the uterus produced by yohimbine ought to be beneficial in chronic metritis and in pyometra, and the drug should be given a trial in these conditions.

The treatment recently recommended by Frasch[3], a German veterinarian, for chronic catarrh of the uterus of the cow is along this line. He uses a mixture of equal parts of oil of turpentine and balsam of copaiba and gives 1 ounce daily in some mucilaginous substance. Under this treatment the discharge is more abundant for the first week, but at the end of the second week it begins to decrease and continues to do so until it finally ceases entirely. The horns of the uterus decrease in size, the cervix if hypertrophied becomes smaller, ovarian cysts or persistent corpora lutea disappear, and in about six weeks normal estrum occurs and conception follows. Of 150 cows treated by Frasch, 90 to 95 per cent recovered. Reinhart, another German veterinarian, has also obtained favorable results with this treatment in many cases, and stated that it is to be preferred to all other internal treatment when local treatment is not possible.

[3] Cited by Frohner, Eugen. Arzneimittellehre fur Tierarzte, 11th edition, p. 399.

As turpentine gives a characteristic odor and taste to the milk when administered to the cow in considerable quantity, this fact will have to be kept in mind in applying this treatment.

Atropine relaxes the muscle of the uterus and is injected hypodermically to overcome straining after the replacement of a prolapsed uterus. It is also recommended for cramp of the os uteri during labor, a condition which is said to be most likely to occur in heifers with the first calf. Chloral dulls the sense of feeling and thus reduces the violent contractions of the uterus which occur in dystokia and in prolapse of the uterus and other irritable conditions. It also causes relaxation of the muscles in general, including the inferior abdominal muscles; and as the latter muscles contribute most of the force in the expulsive efforts which interfere with the operator in his attempts to correct a malposition, their relaxation will make it easier for him to get the fetus in proper position, while the general muscular relaxation will facilitate its delivery. The relaxation of the inferior adominal muscles also adds to the efficiency of chloral in overcoming the straining which is associated with prolapse of the uterus. Chloral by this action and by dulling the sense of feeling facilitates replacement and favors retention. It should be given in large dose and well-diluted in these cases, 1 to 1½ ounces in 1 to 1½ quarts of water with 1 to 1½ ounces of acacia.

Now that veterinarians are being called on to treat a wider variety of diseases of the reproductive organs than heretofore, they will have a greater opportunity to apply the information which has been obtained from animal experiments regarding the physiological action of drugs on these organs, and if they will write up and publish their experiences they will no doubt make valuable additions to a division of therapeutics in which our present knowledge is rather deficient. As stated in the beginning, it is not to be expected that drugs can entirely take the place of the surgical methods which have been developed for the treatment of these cases, but if properly and judiciously employed they may serve as valuable aids to these methods.

THE PHARMACY OF ZINC CHLORIDE IN EXTERNAL VETERINARY PREPARATIONS

By GEORGE E. EWE

Pharmaceutical Research Department, H. K. Mulford Company, Philadelphia, Pennsylvania

ZINC CHLORIDE is used externally as an astringent, escharotic, caustic and disinfectant (1).

McClintic (2) has reported in regard to the reputation of zinc chloride as a deodorant, antiseptic and disinfectant as follows: "Chloride of zinc has had more or less reputation as a deodorant, antiseptic and disinfectant for many years. It is a fairly reliable deodorant in proportions varying between 1 to 500 and 1 to 200. It possesses feeble antiseptic powers. Added to ordinary sewage it will inhibit bacterial growths in proportions varying between 1 to 500 and 1 to 200. It requires 30 minutes for a 25 per cent solution of zinc chloride to kill *Staphylococcus pyogenes aureus.* Spores of *B. subtilis* are not killed in a '100 per cent solution' in 30 days and the spores of *B. anthracis* are not killed in a 50 per cent solution in 40 days."

Babcock (3) used successfully a solution of zinc chloride made by saturating U. S. P. hydrochloric acid with zinc, in the treatment of chronic infected wounds of soft tissue and also of bone involvement. The solution made as prescribed by Babcock contains approximately 22 per cent of metallic zinc, equivalent to 45 per cent of anhydrous zinc chloride.

A dilute solution of zinc chloride is extensively used in veterinary practice for the treatment of suppurating wounds and ulcers.

It is well known that neutral zinc chloride can not be dissolved in water without the formation of the insoluble oxychloride, which results in the production of a cloudy, unsightly preparation. The formation of oxychloride can be prevented by the use of sufficient hydrochloric acid, but this is objectionable because it increases the causticity of the resulting solution without materially increasing its germicidal action.

J. C. and B. L. D. Peacock (4) have pointed out that clear solutions of zinc chloride can be obtained by the use of boric acid or ammonium chloride, and the object of this note is to

suggest the application of one of the methods of producing a clear solution, suggested by them, to the production of a convenient form of zinc chloride for the above-mentioned uses in veterinary practice.

While a dilute solution is popular, it is too bulky to carry around conveniently in a medical bag, and therefore a more concentrated solution of known strength which can be diluted to the desired strength is preferable.

A 25 per cent solution (weight to volume) of zinc chloride (which is about ten times as strong as commonly employed in practice) can be prepared by triturating 25 parts by weight of zinc chloride and 12½ parts by weight of ammonium chloride together, and then adding enough distilled water to yield 100 parts by volume of finished solution. This solution is almost colorless, is perfectly clear when first made, and deposits no more than a mere trace of flocculent precipitate after standing for a month or two. A stronger solution than 25 per cent can be prepared if desired.

Boric acid also yields concentrated solutions similar to those produced by ammonium chloride, but the zinc chloride and boric acid must be used in equal proportions. It is not possible to make as strong solutions with boric acid as with ammonium chloride, and the stronger solutions are not as clear as those made with ammonium chloride.

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After looking over several sections in which to locate, Dr. H. M. Dowling has finally selected Temple, Texas.

The Texas State Board of Veterinary Examiners will hold examinations on June 20 and 21, at Fort Worth, Texas.

At a meeting of the Executive Committee of the Texas Veterinary Medical Association, it was decided to hold the next annual meeting of the association at Fort Worth on June 22 and 23, 1921.

ACTIVITIES OF THE BUREAU OF ANIMAL INDUSTRY LABORATORIES IN WASHINGTON.[1]

By JOHN S. BUCKLEY

Chief of the Pathological Division, Bureau of Animal Industry, United States Department of Agriculture

WHEN it is realized that the science of bacteriology is only seventy years old, and that within the last half of this period the greatest achievements in human and veterinary medicine have been made, as a result of the discoveries in bacteriology, it will be seen that the laboratory workers have been and still are fortunate in having fertile fields for scientific research. During this period the specific causes of many diseases have been unfolded, yet many more apparently as difficult of solution remain to be solved. One is often amazed by the many brilliant discoveries of certain of the many men of science, included among whom were workers in the fields of both human and veterinary medicine. But realizing that all that does *not* glitter is *not* dross, the workers of the Bureau of Animal Industry are heartened by the possibility that some acceptably worthy strides are always to be made, even though no claim is made of the possession of "ultra-microscopic eyes" or prophesying vision. The impulse for discovery is always great, and we believe that even a clue or a method or a hint rightly placed is valuable and may ultimately prove almost as important as the final solution itself. Every day's work in the laboratories doubtless lends some smaller or larger contribution to the knowledge of disease that will help to safeguard the food supply of mankind, indirectly to lighten his burdens, to keep open the channels of trade, to make his living conditions more pleasant, or to save human and animal lives.

Some of the perplexing veterinary problems of fifty years ago remain to worry us now. These problems you encounter every day in your practice or in your sanitary control work. The functions of the Bureau laboratories in Washington are to assist in the elucidation of these problems. Sometimes it is by confirming a diagnosis by microscopic examination or by a

[1] Presented at the Fifty-seventh Annual meeting of the American Veterinary Medical Association, Columbus, Ohio, August 24, 1920.

specific serum reaction. Or perhaps the problem is to identify a poisonous plant, to unravel the origin of an unrecognized disease, to determine the composition and merits of a proprietary dipping fluid, or develop methods of manufacturing certain kinds of cheese.

More specificially, the work of the various laboratories is briefly as follows:

BIOCHEMIC DIVISION

The Biochemic Division conducts biochemical and bacteriological research concerning animal diseases, examines meat products, disinfectants, insecticides and fungicides, and originates dipping solution formulas. It also tests samples of tuberculin, mallein, anti-hog-cholera serum and hog-cholera virus, and performs laboratory work with these products.

Biochemical and bacteriological studies in disease are concerned chiefly with swine diseases. In hog-cholera activities studies are made of the channels of infection, survival of the virus, modes of transmission, infectiousness of the various body secretions, and the persistence of the infection in the hog pens and yards.

Subcutaneous tuberculin and mallein are made in large quantities and are distributed to State and Federal officials and others for use as diagnostic agents. Smaller amounts of ophthalmic tuberculin and mallein have been made for experimental purposes.

Disinfectant materials have been made and tested for technical purposes, such as for treating imported hides and other possibly dangerous products.

Tests are also frequently performed for other branches of the Government service.

ZOÖLOGICAL DIVISION

The routine work of the Zoölogical Division includes the identification of parasites of livestock and man, also those of wild animals, in this and from other parts of the world. The Division examines fecal samples, skin scrapings, etc., for the presence of parasites. It covers the usual work of furnishing information in regard to diagnosis, treatment and prevention of parasitic diseases. The larger part of its work consists in investigations of parasites and parasitic diseases, and it recommends measures for prevention and treatment. The parasites are studied from

the standpoint of their morphology, life history, distribution and classification. The diseases caused by parasites are studied with reference to their pathology, symptoms, diagnosis and treatment or prevention.

The maintenance of an index-catalog dealing with all parasites reported from all hosts in any part of the world is a project which has attracted much attention and is recognized to be superior to any catalog of a like nature to be found anywhere. The parasite collection is regarded as part of the National Museum collection, which is the largest and most valuable in the world.

Important findings have been recorded regarding stomach worms of sheep, ascarids of swine, stomach worms of horses and gape worms of poultry.

Control measures are developed for combating or preventing such diseases as trichinosis and cysticercosis. Anthelmintics have been studied and treatments developed for many worms of the digestive tract of the horse and dog and for the more important worms of sheep, goats, swine and poultry. The Zoölogical Division also gives special attention to the study of parasitic diseases that affect livestock in the South, as apparently there is great need for such work on account of increased livestock following tick eradication.

DAIRY DIVISION

The laboratories of the Dairy Division are devoted entirely to research work. Central laboratories are maintained in Washington with branch laboratories at the Beltsville Experimental Farm, 12 miles out of Washington, and at a creamery at Grove City, Pennsylvania. The work covers all phases of dairy production and manufacture. It includes investigations on the secretion of milk and nurition of dairy cows, taking up such questions as the relation of the mineral salts of the feed and of the animal's blood and the milk yield and similar fundamental studies on the mechanism of milk secretion.

Extensive studies are made of the bacteria occurring in milk, their physiology and classification, channels through which they infect the milk, their action on the milk, and methods of destroying them by heat and other agents.

The laboratory is organized not only for chemical and bacteriological studies, but also for small-scale manufacturing.

Manufacturing investigations include such varied problems as the deterioration of butter in storage, the influence of different constituents on the flavor and texture of ice cream, and the factors influencing viscosity of condensed milk and the coagulating point of evaporated milk. The Dairy Division laboratories discovered the essential bacteria in Swiss cheese, as a result of which they are in position to control the quality of this cheese by the use of such bacteria. Late studies on Roquefort cheese demonstrate that it is feasible to make this cheese from cows' milk under American conditions.

Ways are being studied to use more efficiently the by-products of the dairy industry by the improvement of old and the development of new varieties of low-fat cheeses, methods of utilizing as human food the proteins formerly lost in the whey and the more efficient manufacture and extended use of whey and skimmed milk constituents used in the arts as casein and milk sugar.

Each of the problems on which the laboratory works is organized with chemists, bacteriologists, physiologists or technical men so that all phases of the work can be carried on at one time, and no new manufacturing method is given out until it has passed the test of factory operation.

MEAT INSPECTION LABORATORY

As a part of the Federal meat inspection system the Meat Inspection Division maintains a central Meat Inspection Laboratory which examines meats and meat food products to determine whether the product is properly labeled and contains no deleterious substance. In this laboratory the samples that come under examination are cereals, spices and condiments, coloring agents, curing materials, gelatin, inks and ink ingredients, inedible greases, lards, fats, oils, compounds, oleomargarin, meats, meat food products, mineral oils for denaturing, soup and meat extracts, waters used in official packing establishments, and other miscellaneous substances.

Cases of violation of the regulations with regard to cereals, spices and condiments are due chiefly to dirty, worm-eaten or insect-infested spices. Violations in respect to coloring matters consist chiefly in the use of prohibited substances. Violations regarding curing materials relate chiefly to dirty salt or dirty

sodium nitrate. Gelatin samples occasionally contain excessive quantities of copper and zinc or even arsenic. Methyl alcohol has been substituted for ethyl alcohol in branding inks. Sour and rancid fats are detected in lards, fats, oils and oleomargarin. Meats and meat food products found not to conform to regulations have consisted chiefly of sausages containing excessive quantities of cereals and water. Water samples in a number of instances have shown sewage pollution.

EXPERIMENT STATION LABORATORY

The laboratory at the Experiment Station, located at Bethesda, Maryland, in the Washington suburbs, acts independently and in full coöperation with the city laboratories. Here are conducted studies regarding the causes, character and dissemination of infectious abortion among cattle with special reference to control and prevention. It studies also the cause, character and dissemination of tuberculosis among domestic animals with reference to control and eradication. It conducts from time to time investigations of food products derived from animal sources, looking to the possible occurrence of tubercle bacilli, and suggests means of correcting such contaminations. It makes periodic tests of tuberculin made and sold under Government license.

Tests are made, off and on, of material suspected of being infected with foot-and-mouth disease or other communicable animal diseases, for purposes of control work. Alleged remedies or biological products for infectious diseases of animals are tested. However, from 50 to 75 per cent of the work of the Station is to furnish facilities for the laboratories in the city to maintain domestic animals for experimental purposes under approximately farm conditions and to keep the various disease groups under such conditions that one group does not endanger another. The large majority of small experimental animals used in the various Government laboratories are bred at this Station to insure their freedom from weakness and disease such as are sometimes seen in animals from pet-stock stores.

PATHOLOGICAL DIVISION

The Pathological Division manufactures blackleg powder vaccines and distributes the product to individual stock owners

and to the head veterinary officials of the various States on request.

It examines stock cultures, and biological products made from such cultures, that go into interstate trade for the treatment of animals. The cultures are examined to determine whether they are true to labels, and the biological products are examined to determine, in so far as this is possible, whether they are true to label, i. e., whether they were made from the organisms reputed to have been used in them, whether the product is pure and not contaminated, whether it has any evidence of antigenic value, etc. This work is time-consuming and tedious, but it has been developed to such an extent that much valuable information has been obtained that enables the laboratory to assist materially the Division of Virus-Serum Control in eliminating dangerous and useless products. One of the most interesting of the developments in this work is the identification and differentiation of many anaerobic organisms through serological tests, specifically by complement-fixation tests.

The Pathological Division renders valuable aid to the Field Inspection Division by performing serum diagnosis of dourine and glanders, which tests are also applied to all equine animals coming into this country from foreign ports.

It studies the nature, cause and feasible control measures of abortion disease of cattle, and similar studies are made of any and every other infectious disease of the productive domestic animals, the study of which is not the specific and exclusive project of some other division. Poultry diseases also receive considerable attention, and we feel that it has been possible to render valuable aid in the matter of advice regarding diseases to those interested in poultry keeping.

Specimens of diseased animal tissues received from Federal, State and private sources are examined by pathological and bacteriological methods in efforts to render definite diagnosis for the proper control of the various diseases.

Examinations are made of brain tissues of animals suspected of having been affected with rabies, this work supplementing the work of the District of Columbia Health Department laboratories.

Coöperative pathological and bacteriological investigations are carried out with other Government bureaus, as, for example,

the Bureau of Chemistry in its efforts to enforce the Pure Food and Drugs Act.

Extensive studies are made in the field of the action of poisonous plants on animals, which work is further supplemented in the Pathological Laboratories by chemical and physiological examinations of the active poisonous constituents of the plants. Based on the results obtained, information is furnished to stockmen and the Forest Service through pamphlets, bulletins and other means, so that the plants may be eradicated from certain regions or the livestock kept away from such localities.

POLICY OF SERVICE

The foregoing remarks refer chiefly to current activities of the various divisions, but more important even than the organization of the work and the facilities of the laboratories is the matter of administration. This includes, of course, the selection of investigations and the assignment of problems to persons best qualified to carry them through to successful completion. No doubt it would be possible to obtain greater results in our pure research work on knotty problems if we were left unhampered by necessary routine, but, in keeping with the Department's policy of maximum service to the public, the research work of the Bureau is aimed at problems that require immediate attention or that have caused heavy and regular losses and the ultimate solution of which is most baffling.

It will be seen, therefore, that a systematic plan underlies all of the work, and we feel that there is no problem so difficult that it can not be solved in time through the accumulation of the results of research.

The wife and two daughters of Dr. James A. Waugh of Pittsburgh, Pa., have reached home safely after spending the winter in Southern California.

The Washington Boston Terrier Club recently held its annual show at the Wardman Park Hotel. Among those who won blue ribbons with their pets were Mrs. Dr. Wm. P. Collins with her junior puppy "Fickle Fancy," and Miriam Mohler with her senior puppy "Paddy Boy." Dr. D. E. Buckingham's stud dog "Viscount Dee Cee" was also shown.

CLINICAL AND CASE REPORTS

(Practitioners and others are invited to contribute to this department reports of unusual and interesting cases which may be helpful to others in the profession.)

A NEW INSTRUMENT FOR DYSTOKIA

By G. E. JORGENSON, *Clermont, Iowa*

I HAVE recently succeeded in having patented a new obstetrical instrument which I have devised. Believing that this is of interest to the general veterinary practitioner, a description covering it and its use is submitted with an illustration.

In many cases of dystokia of large animals it becomes necessary to resort to considerable force to relieve the patient. This has up to the present time been accomplished by the use of a block and tackle. This requires a stable object in the rear of the patient and one in front. The first is to anchor the blocks and the latter to allow the patient to be tied fast. These anchors are in many cases not available or at least not in the position that will allow the fetus to be removed along the birth canal over the path of least resistance.

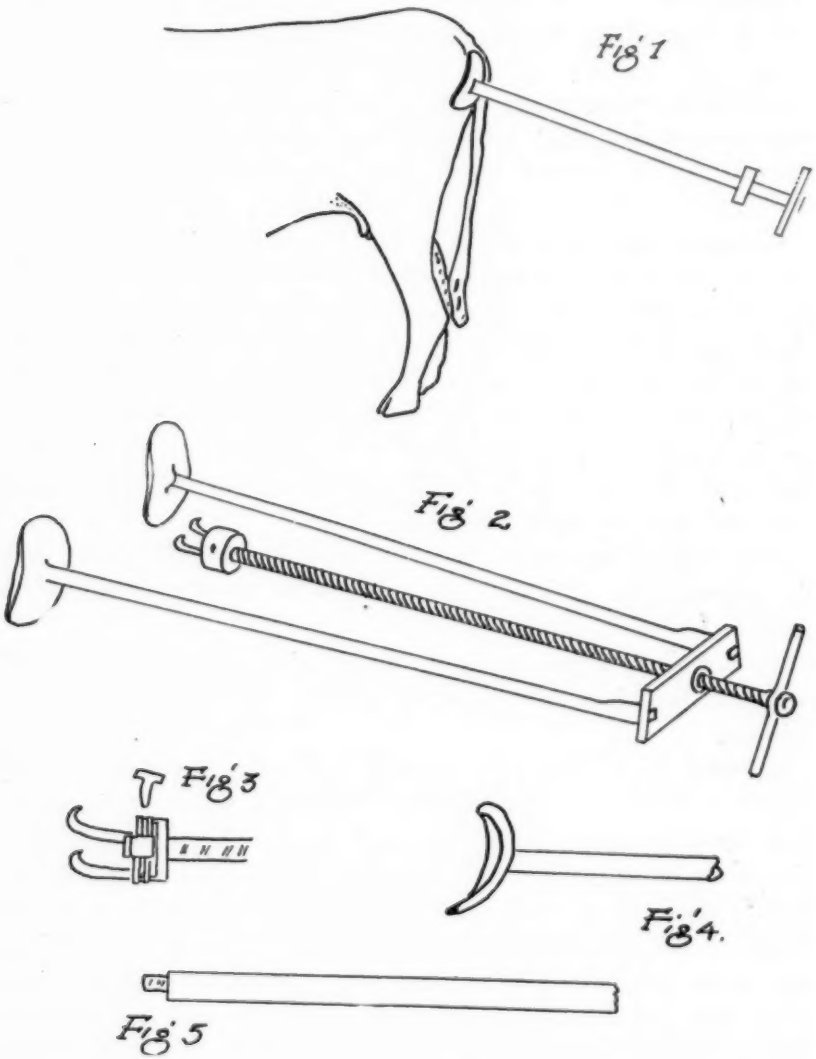
The present instrument is constructed so that this object may be accomplished without this cumbersome apparatus and in a more scientific manner.

Its action is based upon the diametrical opposite of a jack screw, in that it pulls instead of pushes. Its construction is as follows:

A screw shaft four and one-half feet long, threaded the full length, is fitted into a head tapped and threaded to fit the shaft. This head is supported by two steel legs of the same length as the screw shaft. They are attached to the head with pins allowing them to be widened or narrowed at the base to fit the width of the hips of the patient. The other ends of these legs are fitted into specially molded feet. They are screwed into these feet, which are concave both vertically and horizontally, and are somewhat lipped at the inner edge to grasp the thigh, against which they thrust. The screw shaft is fitted in one end with a handle and in the other a swivel is attached fitted with hooks. This swivel may be immobilized on the shaft to allow a

turning as well as a pulling movement, if such is found necessary.

The instrument is operated as follows: An assistant holds the instrument against the hips of the patient while the ropes attached to the fetus are fastened to the hooks. The operator then turns the handle so that the screw shaft travels outward.



With the leg placed against the hips of the patient, a pull is exerted upon the fetus which is pulled outward and finally delivered. If the fetus still sticks after the first part presented

is delivered, the additional lengths are fitted to the legs and the process repeated.

The instrument has been thoroughly tried out and has given perfect satisfaction in over 20 cases, some unusually difficult.

UNIVERSITY OF PENNSYLVANIA CLINICS

The report of the ambulatory clinic of the School of Veterinary Medicine at the University of Pennsylvania shows that 3,379 animals were treated last year on farms within reach of the school by automobile. The patients included 78 horses, 2,162 cattle, 41 sheep, 577 swine, 520 chickens and 1 dog.

Cases treated in the hospital during the same period totaled 5,195. In the surgical clinic 265 horses, 8 mules, 2 cows and one hog were treated and of these 146 were subjected to general anesthesia. The animals treated in the medical clinic numbered 102. In the free dispensary for large animals 600 patients received treatment, this figure including both medical and surgical cases. The small-animal clinic had 4,217 cases, 2,492 in the hospital and 1,725 in the free dispensary. The hospital cases included one skunk from which the scent glands were removed.

The figures for the previous year were: Surgical clinic, 260 cases; medical clinic, 89; free dispensary for large animals, 523; small-animal clinic, 3,839 (hospital 2,211, free dispensary 1,628), the total for the year being 4,711.

B. H. RAWL RESIGNS FROM B. A. I.

B. H. Rawl, assistant chief of the Bureau of Animal Industry, has resigned, after 16 years of service with the Government, to take charge of the educational work of the California Central Creameries. He will have headquarters in San Francisco.

Mr. Rawl was made chief of the Dairy Division in 1909 and assistant chief of the Bureau of Animal Industry in 1918.

He is one of the most widely known dairy specialists in the world. A native of South Carolina, he is a graduate of Clemson College. He took special work in dairying at Pennsylvania State College and the University of Wisconsin. He inaugurated the educational work of the Dairy Division in the Southern States and later was placed in charge of all production work of the division. He has been largely instrumental in bringing about the great advance of the past decade in scientific dairying.

ABSTRACTS

THE PATHOGENIC EFFECTS CAUSED BY INTESTINAL PARASITES. D. A. De Jong. Nach Tijdschrift voor Diergeneeskunde, vol. 47 (1920), no. 2, p. 82.

THE AUTHOR alludes to the injurious effects caused by intestinal parasites in their hosts. These injuries depend on the life habits of the parasite in the digestive tract, as for example, irritation of the mucous membrane, or mechanically through their presence in large numbers; also through traumatism, boring through the mucous coat and lodging themselves in the intestinal wall. Anemia is a result of harboring blood-sucking parasites. In the case of infestation by *Dibothriocephalus latus,* the anemic condition of the host is due in part to the toxins which the parasite secretes and which the host absorbs. Aside from the parasitic toxins, harmful and deleterious material is absorbed as a result of injury to the intestinal walls which is not possible when the mucous coat is uninjured. The nervous symptoms exhibited by the host as a result of parasitic irritation of the intestinal wall and considered heretofore as reflex in character, are now known to be due to toxins which the parasite secretes. The most serious effects are those which follow injuries to the intestinal coats for the reason that pathogenic bacteria, such as the coli and proteus, gain entrance and infectious diseases such as typhoid, paratyphoid, cholera and dysentery are contracted, which otherwise could not have occurred had the intestinal mucous membrane been in its normal condition. Statistics prove that persons harboring intestinal parasites are more frequently attacked with typhoid fever than healthy persons. All intestinal parasites should be expelled. The primary injuries are easily underestimated, the secondary, particularly the origin of infectious diseases, can only be avoided by removal of the parasites. J. P. O'LEARY.

THE WHITE CELL BLOOD PICTURE IN GLANDERS OF HORSES. Hans Witte. Monatsch. Prakt. Tierheilk., vol. 36 (1920), pp. 429-446.

A LARGE number of detailed differential counts of white blood cells were made. In glanders there is an increase in the

number of leucocytes, especially neutrophile or polymorphonuclear leucocytes. The increase is not found, however, in horses recently infected, recovered, or only slightly infected. The results agree with those of Fröhner, Pruss, Mielke and others, but contradict the work of A. Schulze, who claims to have found a pronounced diminution in the number of polymorphonuclears in glanders. W. N. BERG.

CHANGES IN THE BLOOD AND BODY TEMPERATURE OF THE HORSE FOLLOWING SUBCUTANEOUS AND INTRAVENUS INJECTIONS OF HOMOLOGOUS NORMAL BLOOD, SERUM AND ERYSIPELAS SERUM. H. Warnatch. Monatsch. Prakt. Tierheilk., vol. 31 (1920), pp. 413-428.

THE BLOOD picture of a normal horse is not altered on intravenous injection (transfusion) of normal horse blood, defibrinated or undefibrinated; normal serum or erysipelas serum, neither is there any fever. But the picture is changed when blood from a case of infectious anemia is injected into a normal horse. Of particular value in the diagnosis of infectious anemia is the rise in temperature and its course, lowering of red cell count, and the rise in white cells. The failure to obtain these changes, however, must not be interpreted as proof of the absence of the disease in the donor. The results indicate the correctness of Fröhner's view that infectious anemia is probably a septicemia having a chronic course, the anemia being secondary. W. N. BERG.

MEXICAN RED FEVER OF SWINE AND ITS PREVENTIVE VACCINATION. E. Lopez Vallejo. Mem. y Rev. Soc. Cient. "Antonio Alzate," vol. 38 (1919), no. 5-8, pp. 277-289.

DR. VALLEJO furnishes a good description of the symptoms of swine erysipelas and it is therefore inferred that Mexican red fever of swine is a synonymous term with rotlauf, rouget, and swine erysipelas. The article also contains a summary of the microscopic, cultural, and biochemical characteristics of the causative microorganism, and an account of the methods employed in securing immunization against the disease, which consist chiefly in inoculating the animal with attenuated cultures of the bacillus.

DOMESTIC ANIMALS AS FACTORS IN THE SPREAD OF INFECTION. W. G. Savage. Medical Officer, vol. 24 (1920), no. 18, pp. 181-183.

THE RELATION of bovine mastitis to human disease is a very important one. The chronic form of mastitis is usually due to the tubercle bacillus or less commonly to actinomycosis. Probably the average prevalence is about one per cent. This is the most important source of tubercle bacilli in milk and a potential cause of human tuberculosis. Of the acute variety of mastitis about 70% is due to streptococci, about 16% to staphylococci and the remainder of doubtful bacteriology. The *Streptococcus mastiditis* which morphologically and culturally resembles the pathogenic streptococci of man, differs from the latter in not being pathogenic. It has been definitely shown that the strains of streptococci of bovine mastitis which are dangerous to man are hemolytic while the streptococci of ordinary bovine mastitis are non-hemolytic. These streptococci gain access from an infection from the milker, whose hands are contaminated perhaps from a sore throat.

Concerning food poisoning outbreaks and domestic animals we may accept it as definitely established that all or almost all the outbreaks involving groups of persons are due to infection of the food eaten with members of a particular group of bacilli, the Gaertner group, the infecting bacilli being either *B. enteriditis*, *B. suipestifer*, or *B. aertrycke*. The actual source of infection of the food is, in the majority of cases, not *intra vitam* from infected animals, but through secondary infection of sound food. In a minority but still a very considerable portion, it is due to infection of the living animal with one of these bacilli.

In connection with the question of the secondary infection of food the importance of rats and mice must not be overlooked, since these animals are frequently infected with Gaertner group bacilli, and such infected animals or those which have recovered and still harbor the bacilli may act as vehicles of infection.

Concerning the relation of diphtheria and cats, an extensive series of experiments conducted by the author justify the opinion that the common and widely accepted view that cats can suffer from a naturally acquired disease caused by the diphtheria bacillus is entirely without foundation. The reported cases of such an association are based upon insufficient examination and

differentiation of the bacilli found, due to a failure to realize that a large proportion of healthy, normal cats contain in their throats bacilli which closely resemble, and are difficult to distinguish from the true *B. diphtheriae*.

ENTERITIS PARATUBERCULOSA (JOHNE'S DISEASE). Zwynenberg. Ann. Méd. Vét., Aug.-Sept., 1920, p. 378. Abst. in Rev. Gén. Méd. Vét., vol. 30 (1921), no. 350, p. 73.

IN HOLLAND this affection is of more frequent occurrence than has been believed. On a farm with a herd of five cows, three of them were found to be affected with Johne's disease after examining fecal material by the Webster-Beyers method. The author resorted to the treatment recommended by MacFadyean, which consists in the administration of 30 grams of the following preparation in a half liter of water:

Iron sulphate	
Dilute sulphuric acid aa	**142 gms.**
Water	**564 c. c.**

This treatment was continued for fifteen days, when the animals were turned out to pasture. After five months at pasture the symptoms of enteritis disappeared and the general condition was perfect.

The author is of the opinion that the MacFadyean medication exerts a caustic action which arrests the progress of the lesions; part of the mucosa may become detached and regenerated after elimination. He believes that putting the cattle on pasture may be useful.

L. T. GILTNER.

REVIEW

MANUAL OF VETERINARY PHYSIOLOGY. By Major General Sir F. Smith, K. C. M. G., C. B., Fellow and Honorary Associate of the R. C. V. S., formerly Director-General, Army Veterinary Service. 5th edition, 1921, 893 pages, with 273 illustrations. Alex. Eger, Chicago. Price $7.50.

WE ARE pleased to note the appearance of the fifth edition of this standard work on physiology, which, since the publication of the first edition in 1892, has been generally accepted as a text

book in institutions where veterinary medicine is taught, and its value widely recognized and appreciated.

The present edition has been extensively revised. It is divided into twenty chapters which treat of the following subjects: The Blood, The Heart; The Blood-vessels; Respiration; Digestion; The Liver and Pancreas; Absorption; The Endocrine Glands and Internal Secretions; The Skin; The Urine; Nutrition; Animal Heat; The Muscular System; The Nervous System; The Senses; Locomotor System; The Foot; Generation and Development; Growth, Decay and Death; The Chemical Basis of the Body.

Two hundred and seventy-three cuts are inserted which serve well to illustrate the text.

To Chapter XVIII is added a fourth section on breeding which is contributed by J. B. Robertson, M. R. C. V. S. Prof. T. H. Milroy, M. D., is given credit for the preparation of Chapter XX, on "The Chemical Basis of the Body."

The fifth edition contains 84 pages more than the previous revision, but in spite of this fact is a more compact volume, due to the use of lighter weight paper by the publisher.

A considerable portion of the added space is given to those chapters dealing with Generation and Development, and with Nutrition. The author in the preface referring to the more lengthy discussion of the former subjects states that "no apology is made because of this feature inasmuch as these are topics of extraordinary interest to the veterinarian." The knowledge gained from the more recent investigations that have been conducted along the lines of food requirements has unquestionably justified dealing with the chapter on Nutrition at greater length than in previous editions.

Emphasis has been placed upon the fact that the work should be regarded as a veterinary and not a comparative physiology for the reason that it treats of the science "not only from its theoretical aspect but discusses its bearing on veterinary medicine, surgery and hygiene." The pathological appendix that follows nearly every chapter directs attention to this particular feature.

The systematic arrangement of the contents of the work, and its concise though clear manner of description render it especially attractive to both student and practitioner as a text book or as a work for reference purposes. J. M. B.

ARMY VETERINARY SERVICE

To the Editor:—

May I not say a word or two on Army matters for publication? Several days ago while in Texas I glanced through the Journal and perused with interest someone's objection to a physician at the head of the U. S. Army Veterinary Corps. The writer remarked, "There must be a veterinarian in this great country competent to head this corps." My answer is, "Sure." A few impressions of a graduated veterinarian who couldn't see himself in the Veterinary Corps because he had (and I am not an egotist) too much pride in himself. I enlisted in the line, was afterwards made a commissioned officer and, still better, was advanced a grade while in France. The fault with our Veterinary Corps is that "within itself," it is composed of the type of officer which formed the nucleus of our enlarged corps. Years ago men in the veterinary corps were, as I have learned, mere stable sergeants. I can't imagine many high-grade veterinarians striving for such positions. I have not practiced in some years, but during our first year of the war, in the interest of my firm, I called on a number of training camps. I distinctly remember two of the old army veterinarians, one at a camp in a northwest State, the other one I saw only once, but heard a lot about him while he was on a sort of observation or inspection trip to a National Guard camp here in the South (right in this State, at Alexandria). I wish to injure no one's feelings when I say that these two men were in every sense of the word "horse doctors" in all we, as veterinarians, imply when we use this title. Further, I expect these men are now way up near the top of the Veterinary Corps. Doctor David White, of Ohio University, went to France and became the head of the A. E. F. Veterinary Corps. He is a big man and able to stand on his own feet. He wouldn't stand the "bulldozing" old regular officers had been used to, due to their utter slipshod and helpless sort of attitude. He was transferred somewhere else and a cavalry officer placed in charge who worked, as I understand it, practically upon the advice of a young reserve officer, to the great wonder of a lot of regular officers, who themselves were and had been for years "asleep at the switch." I understand the great war cry of a

lot of the old veterinarians is, "be a horseman." Are they horsemen? If so, why don't we hear and read of them as horsemen in the various military and veterinary journals? Here is the discouraging question: Is this thing going to perpetuate itself? I am, perhaps, no great judge, just a business man who has to keep up with the times. If a few of the younger veterinarians in the Army whom I have had occasion to size up are ever called upon to handle big problems in time of need, something is going to "break." It is very true that men who have good practices can't afford to leave them and go into the Army. The great U. S. Bureau of Animal Industry seems to me to be high class as to its veterinary personnel. Is it because a veterinarian is at its head? If so, for heaven's sake, give us a veterinarian's Veterinary Corps in our Army.

New Orleans, La. J. B. ROBISON.

Dr. L. E. Miller, formerly in the Army Veterinary Corps, has recently located at Corpus Christi, Texas, to engage in general practice.

Dr. B. C. Flook has just returned to Canada, after a prolonged service with the Imperial army. He will resume the practice of his profession at Erikdale, Manitoba.

Dr. O. W. Anderson, of Brunswick, Neb., who has been connected with the Army Veterinary Corps and more recently with the B. A. I., has accepted a position with the Portland, Oregon, Board of Health.

T. Charles Evans, Lieut.-Colonel, R. C. A. V. C., in addition to being Senior Veterinary Officer for the District of Ontario, is occupying the position of honorary editor of the *Canadian Veterinary Record*.

When you read of the millions of dozens of eggs that are brought into this country from China, and read of the millions of children that are starving in that country, we wonder why they don't keep these eggs home and keep the children from starving.—*Milk Reporter*.

ASSOCIATION NEWS

THE COLORADO CONVENTION

Reports from Colorado in general and Denver in particular are indicative of a royal reception for our members as they detrain in this "Paris of America" on the occasion of the convention of the American Veterinary Medical Association there in September.

Reports from members, in turn, indicate a somewhat lively interest in this rather unusual opportunity to pleasingly combine a business and a pleasure or vacation trip.

That there'll be plenty to see, as well as to do, is apparent. A young woman, anxious to learn, once commanded a man who had tramped over Colorado for a decade to tell her of "all he saw." The man replied, that as he had but another twenty years to live, there wouldn't be time enough.

Seemingly far-fetched, this laconic reply was less exaggerated than one who never has visited the State might suppose. That is easily comprehended when one understands that Colorado is considerably larger than all the New England States and two-thirds of it is mountainous—not such as claim that name in Eastern States, but the "real thing." The height of the average Allegheny mountain is about 2,500 feet. Out in Colorado the average height of the "Old Guard" of the Continental Divide

Arapahoe Park and Glacier in Boulder County, Colorado—One of the most magnificent of all the mountain sights of all Northern Colorado—a one-day round trip from Denver.

ranges from 11,000 to 14,000 feet above the tides of the ocean.

Denver is the gateway and starting-out point for all Colorado, and it has been predicted that after the adjournment of the convention our members will display an aptitude to start out and see these mountain wonders that will convince the Denverites that they know a good thing when they see it.

That the forthcoming convention promises to go down on record as the most beneficial from a professional, as well as a health standpoint, seems certain. Determined that the comfort of our members shall not suffer, President White has decided upon a special train for our exclusive use, and the C. B. & Q. R. R. has promised to protect our needs in such a way that the going may be counted as one of the real pleasures of the trip. Complete details as to time and date for departure, fares, etc., will be forthcoming at the proper time.

NEW MEMBERS

During the war the A. V. M. A. had an unusual increase in new members, but since war activities ceased the number of applications for membership has fallen greatly in spite of special efforts that have been made.

Our association is in an excellent condition, but we need to increase our membership. To do this we must depend upon each individual member to do his part. It requires a personal effort. It is impossible for your officers to get in touch with all of those who should join the A. V. M. A.

There is probably no veterinary association that offers more for the annual dues of $5 than does the A. V. M. A. It is the largest and most efficient veterinary association in the world. Every member of the A. V. M. A. should make an effort to get at least one new member. This is your association. Do your part to make it larger and better. If you can't get a new member get a subscriber to the JOURNAL, and be sure and send in case reports and practical suggestions and news items for the JOURNAL.

Send me a postal card and I will forward application blanks to you, and a personal letter to any prospective member if you think it will help. George is willing and anxious to do his part. Will you do yours and get a new member?

N. S. MAYO.

ILLMO VETERINARY MEDICAL ASSOCIATION

The Illmo Veterinary Medical Association met in the Live Stock Exchange room, National Stock Yards, Ill., March 17 and 18.

Mr. Wm. Moody delivered the address of welcome, which was greatly appreciated by the visiting veterinarians. After this the regular program was carried out, as follows:

Transportation of Live Stock, W. J. Embree, Chicago, Ill.

Diseases of Suckling Pigs, A. T. Kinsley, Kansas City, Mo.

Abortion Disease and Sterility of Cattle, C. H. Jungerman, Hiawatha, Kansas.

Handling of Vaccinated Swine to Eliminate Bad Results, M. M. Huggins, National Stock Yards.

These papers were most excellent and the meeting proved very beneficial as well as instructive.

Dr. J. I. Gibson, of the Illinois State Association, gave a talk along the lines of the welfare movement and coöperation between the livestock men and veterinarians, which was very interesting.

After Dr. Gibson's talk there was a banquet at the National Hotel, with about thirty present, after which the program was continued.

Dr. Salsbery, of Kansas City, gave a very interesting talk along the lines of the work being done by the American Horse Association.

Dr. E. W. Saunders gave a lecture on Infantile Paralysis, which was very fine, after which Dr. Robert Graham, of the University of Illinois, gave a lantern slide lecture on Botulism Intoxication in Animals.

The second day's meeting was called to order by Dr. McKinley and was of a business nature. Among other things, St. Louis, Mo., was selected for the next regular meeting, which will be held in October.

A vote of thanks was extended to the National Live Stock Exchange and the National Stock Yards for their very courteous and considerate attention given the meeting, after which the members adjourned to the vaccinating department of the stock yards, where a demonstration of the intraperitoneal method of vaccination was given.

A very interesting clinic on the intradermal reaction in cattle

was held at Armour & Co. The collection of pathological specimens, collected by the B. A. I., under Dr. Jenison, was very elaborate, covering many different diseases.

The program concluded with a clinic at Dr. Farris's hospital on St. Clair Avenue.

There were almost twice as many in attendance at this meeting as have attended any previous meeting.

J. E. JENNINGS, *Secretary.*

ALABAMA VETERINARY MEDICAL ASSOCIATION

THE FOURTEENTH annual meeting of the Alabama Veterinary Medical Association was held at the College of Veterinary Medicine, Auburn, Alabama, February 23, 24, 25 and 26.

A paper on septicemia in chickens was read by E. Everitt. This was followed by another paper on roup, diphtheria and sore head in chickens, by F. D. Patterson. The common diseases of the cat were next considered by N. B. Tyler. This was followed by A. L. Holloway with a paper on diseases of rabbits. These four papers drew forth many questions and suggestions from practitioners. They were eagerly followed by the attending veterinarians, because the average practitioner is now going out after all lines of practice, even the small-animal practice.

The time-worn distemper in dogs was next considered by Dr. G. S. Phelps. It called forth a variety of opinions, methods and theories. It seems that there is still something to find out about long-known uncontrollable and untreatable dog distemper.

Dr. J. S. Andrade, read a paper on mastitis in cows. He stated that most cases of chronic parenchymatous and catarrhal forms were incurable. Acute and sub-acute cases can sometimes be treated successfully. Warm water fomentations, applications of antiphlogistine, injections of boric acid solutions and the administration of 1 quart of coffee with 1 dram of formalin, 3 times a day for three to five days in acute cases of mastitis, were advised by him.

The subject of traumatic pericarditis was not taken up by a paper. But the veterinarians present were anxious to have a round table discussion on this subject, and they had it. How may one make a positive diagnosis of an acute case in the early stage when it might be possible to remove the penetrating

foreign body by doing rumenotomy and thus save the life of the animal?

The men in practice want a means of making a definite, early diagnosis. After all it seems the only way is by exploratory diagnostic and remedial rumenotomy. In the chronic case it was agreed that the most constant or most nearly accurate diagnostic symptom was the edema of the brisket and substernal regions. From the literature it appears that there is no accurate means of making a clinical diagnosis of traumatic pericariditis 100% true.

It is always interesting to call up digestive tract diseases of mules and horses; Dr. M. F. Jackson touched the "button" and sparks of opinions came out. Dr. Jackson handles the mine mules for the great T. C. I. Company in the Birmingham District. He prevents digestive diseases by careful feeding and handling.

Dr. H. C. Wilson read a short B. A. I. Bulletin on necrobacillosis in swine and then commented on it.

A new treatment for stomach and intestinal worms in cattle and sheep was next explained. This treatment has been successfully used by the McNeill Experiment Station of Mississippi:

Copper Sulphate	8 ounces.
Snuff	8 ounces.
Water	5 gallons.

Soak the snuff over night in 1 gallon of water. Dissolve the copper sulphate in 2 gallons of water. Mix and strain, and add water to make 5 gallons. The dose is the same as when giving the one per cent copper sulphate solution for stomach worms. Repeat the treatment in 7 days.

Dr. D. J. Meador read a paper on osteomalacia, a disease found in the coastal plains or wire grass region of the South. It is apparently due to want of proper vitamines—a deficiency disease affecting not only the bones but the muscles. Numerous reports of various kinds of cases were put before the members for diagnosis, treatment and general discussion.

Dr. N. G. Covington held a complete autopsy (after Crocker) on the cadaver of a heifer. Emaciation, anemia and parasites in the stomach and intestines were found.

Tuberculosis and tuberculin testing was the next on the program. Dr. R. S. Sugg led off on tuberculin testing of hogs. He

advises the intradermal test applied to the ear. In his experience every reactor gave positive lesions on postmortem. It can be applied in combination with the ophthalmic test. Dr. Elmer Lash of the B. A. I. read his paper on the combination tests. He advocated the combination only of:

(1) Intradermic and ophthalmic.

(2) Subcutaneous and ophthalmic.

Dr. C. J. Becker then read and explained the B. A. I. Regulations covering tuberculin tests for making accredited herds and for interstate shipment.

These papers led to numerous discussions and questions, because many of the veterinarians anticipated taking the examination required by the State and B. A. I. for testing accredited herds.

About 12 cows and calves and 10 hogs were tuberculin tested by the combination methods. Only one cow reacted. The reactor gave positive intradermic and ophthalmic reactions. She was slaughtered and lesions were found in the mesenteric, mediastinal and bronchial lymph glands, and in apical lobe of the lungs.

One night and one afternoon were taken up by the veterinarians present reviewing the pathology and lesions of tuberculosis in cattle and hogs; also the different tuberculin tests and the State and Federal regulations were discussed, all of which was found to be good preparation for the examination.

Thursday night the College Veterinary Medical Association gave a banquet at the Varsity Cafe. Nearly 150 attended and the toasts were timely, fresh and digestible, as well as laugh lifters.

On Friday a polyclinic was held for the benefit of the association members. The weather was ideal. Three cases of fistulous withers were exhibited, all of which had previously been given a radical operation and all diseased tissues (muscle, fascia, ligaments and bone) had been removed. Each one was making a good recovery. One ventral hernia operation in a pig was performed. One tumor was removed from a mule. A mule was exhibited that had been operated on by the French method for cartilaginous quittor and the cicatrix still caused some pain; then metacarpal neurectomy was done on that side, removing the pain and lameness. Another case was a mule with enlarged and

contracted flexor pedis tendons. The high and the low tenotomy operations had been done and the mule remained very lame. Then median neurectomy was done. Mule was still somewhat lame. A litter of six setter pups, eight weeks old, each one having a good case of rachitis, were exhibited for diagnosis and treatment.

On Saturday morning 30 veterinarians worked on the Federal and State examination from 9 a. m. until 12 noon, so as to be given the right to test accredited herds. It appears that some veterinarians look upon tuberculin testing as easy work. But the profession must know that it is difficult and that the art of applying and interpreting the reaction requires skill, study and close and careful scrutiny. Make it accurate and then it will mean something and be accredited in fact.

C. A. CARY, *Secretary.*

PENNSYLVANIA VETERINARY MEDICAL ASSOCIATION

The thirty-eighth annual meeting of the Pennsylvania State Veterinary Medical Association was held in Harrisburg, Pa., January 25 and 26, with headquarters at the Penn-Harris Hotel.

The meeting was called to order by the president, Dr. H. E. Bender. The following papers were read: "A Few Things Learned in Thirty Years' Practice," by E. E. Bittles; "Experiences in General Practice," by D. R. Kohler; "Traumatic Pericarditis in Cattle," by A. L. Schonck; "The Dissemination of Anthrax Infection through Industrial Sources," by Adolph Eichhorn; "The Action of Drugs on the Uterus," by L. A. Klein; "Modern Biologics," by E. A. Cahill; "Antiseptics and Germicides in Surgical Conditions of Living Animals," by John W. Adams; "Our Profession," by David S. White, president A. V. M. A.; "The Relation of Veterinary Extension Work to the Practicing Veterinarian, the Livestock Industry and the Public Health," by George H. Hart; "The Veterinarian and the Community," by H. W. Barnard; "The Swine Situation in Pennsylvania," by H. R. Church; "Diagnosis of Pregancy," by C. J. Marshall; "The Present Status of the Horse Industry in Pennsylvania," by G. A. Dick; "A Synopsis of Sterility and Abortion Work," by W. H. Ridge; "The Progress of Tuberculosis Eradication in Pennsylvania," by S. E. Bruner.

There were about two hundred and twenty in attendance. A great deal of interest was shown in the meeting, and everyone felt free to discuss and pass opinion on all the above papers. From the time the meeting started early Tuesday morning until late Wednesday evening there was always something doing. This was the best meeting I have attended for several years.

The following officers were elected for the coming year: President, John W. Adams; vice-presidents, H. R. Church, E. C. Deubler and John Reichel; recording secretary, C. S. Rockwell; corresponding secretary, R. M. Staley; treasurer, Thomas Kelly; trustees, H. E. Bender, Wm. J. Lentz, O. E. Quinn, H. W. Barnard and W. D. Ellis.

C. S. ROCKWELL, *Resident Secretary.*

MASSACHUSETTS VETERINARY ASSOCIATION

The regular meeting of the Massachusetts Veterinary Association was held at the New American House, Boston, Wednesday, February 23, 35 members being present.

John B. Lentz, V. M. D., of Amherst, and Lawrence H. Batchelder, V. M. D., of Millbury, Mass., were admitted to membership.

A discussion of the different bills before the Massachusetts House and Senate was held. The association voted to appear in favor of Senate Bill No. 69, relative to payment for cattle reacting to tests made under the jurisdiction of the United States Bureau of Animal Industry and Massachusetts Division of Animal Industry. The association voted not to appear in favor of House Bill No. 536, allowing veterinarians not connected with the Division of Animal Industry to use anti-hog cholera serum and virus.

It was also voted to arrange to hold a meeting of all New England veterinarians some time during the month of June, such meeting to be held in conjunction with the United States Bureau of Animal Industry. A committee of five was appointed to arrange for the date and place of meeting, said committee to make a preliminary report at the March meeting.

The Massachusetts Veterinary Association and the Massasetts Division of Animal Industry, together with State and

Federal employes engaged in cooperative tuberculosis eradication in New England and veterinary practitioners and representatives of the livestock industry, are to hold a tuberculosis eradication conference in Boston, Mass., on June 22, 23 and 24.

An interesting program has already been arranged for this meeting, and special arrangements are being made for entertainment of the ladies.

It is hoped that veterinarians or persons interested in such a meeting, residing outside of New England will avail themselves of the opportunity of meeting the New England veterinarians at this conference. HARRIE W. PIERCE, *Secretary.*

IDAHO VETERINARY MEDICAL ASSOCIATION

I am enclosing herewith a copy of the constitution and by-laws of the I. V. M. A. Inc., also a program of our first annual meeting held during the latter part of January, and a copy of the new veterinary law of Idaho just passed.

The graduate veterinarians of Idaho have felt for years that the State has been a black spot on the map as far as laws protecting and advancing the profession were concerned. Therefore as soon as the association was formed and incorporated, a committee was appointed to draft a bill to be presented at this session of the Legislature.

The association started with a charter membership of 14 graduates and at our first meeting we had about 50 in attendance all of whom joined.

Some of the members have been rather insistent that I get in touch with you, which I refused to do until I could report something definite in advancing the profession in Idaho.

The officers for 1921-1922 are: President, Dr. Ray P. Hurd; Vice-President, Dr. E. T. Powell; Secretary and Treasurer, Dr. H. C. Luce. HARRY C. LUCE, *Secretary.*

A NEW PRACTICE LAW IN IDAHO

THE LEGISLATURE of Idaho has just passed a bill regulating the practice of veterinary medicine in that State.

The new bill is an excellent one; it provides for an examining board of three members. This Board not only gives examina-

tions but is empowered to revoke licenses. It also determines the standing of veterinary colleges as to whether the graduates shall be eligible to take the examinations.

The law specifically provides that no one is allowed to practice veterinary medicine, surgery or dentistry, or perform surgical operations on or prescribe for any physical ailments or deformity or injury to any domestic animal, or to administer hog cholera virus, anthrax vaccine, or to use tuberculin or mallein as diagnostic agents, unless he is registered in that State.

ONTARIO VETERINARY ASSOCIATION.

A general meeting was held at the Ontario Veterinary College, Toronto, on February 16 and 17. Although the number present was not so great as at the annual meeting, different parts of Ontario were well represented, and the holding of semi-annual instead of yearly meetings was justified.

The meeting convened in the Assembly Hall at 10 a. m., the President, Dr. J. A. Campbell, presiding.

An address of welcome was given by the Hon. Manning W. Doherty, Minister of Agriculture, followed by an address by Dr. J. G. Rutherford, of the Board of Railway Commissioners. Both gentlemen emphasized the great responsibility resting upon the veterinarian in furthering the development of the livestock industry.

Letters and telegrams from the following were then read, regretting their inability to be present at the meeting, and expressing their wishes for its success: The Hon. S. F. Tolmie, Federal Minister of Agriculture; Dr. F. Torrance, Veterinary Director General; Dr. Hastings, Medical Officer of Health, Toronto; Dr. E. A. A. Grange, Principal Emeritus, Ontario Veterinary College, and Dr. Geo. Hilton, Chief Inspector, Health of Animals Branch.

The afternoon session commenced at 2 o'clock, with a discussion on the Veterinary Practice Act. Dr. McGilvray was the first speaker and fully explained all that had been done in connection with the registration of non-graduates. He pointed out that the members of the Veterinary Practice Board had thoroughly investigated every application and no certificate had been granted until they had satisfied themselves that the man

was entitled to it according to the provisions of the act. Others taking part in the discussion were Dr. Fowler of Toronto, Dr. Hutton of Welland, Dr. Caley of Bracebridge, Dr. Kelly of Orillia, Dr. Watson of the Biological Laboratory, Ottawa, and Dr. Rutherford. Moved by Dr. Wilson, seconded by Dr. Culp, and unanimously carried that this association pass a resolution, giving its confidence to the Board as they had done everything in their power in behalf of the veterinary profession.

The next item on the program was a discussion regarding the advancement and support of the Canadian Veterinary Record. This journal is now edited by Col. T. C. Evans, who explained to the meeting the necessity for an increased subscription list. It is the intention to publish the magazine quarterly instead of semi-annually.

Before proceeding with the symposium on contagious abortion and sterility, Dr. W. H. Moffatt of the V. V. M. Laboratories was invited to address the meeting and explain the nature of his preparation which he is distributing as a preventive and cure of contagious abortion. Dr. Moffatt stated that he was not there to discuss V. V. M. as regards its composition, but merely to tell the effect of its administration in herds where contagious abortion had occurred, and that he did not want any judgment passed at this meeting regarding the efficacy of the product. There was considerable discussion after Dr. Moffatt had presented his paper, in which Drs. Batt, Gwatkin, Law, Watson, McGilvray, Rutherford and Col. Mundhenk took part. The general impression created by the paper was that V. V. M. had not been proven a cure or preventive of contagious abortion.

Dr. R. I. McIntosh was then called upon to address the meeting on sterility. His address dealing principally with the physiological feature of the disease was greatly appreciated.

Dr. Batt briefly outlined the physiology of the corpus luteum.

At 7.30 p. m. a banquet was held at the Walker House, at which about forty-six were present. After an enjoyable dinner, accompanied by selections on the piano, Dr. Rutherford was the first called upon to speak. His address was witty and interesting, dealing principally with his experiences when he first graduated and practiced in Indiana, New York State, Mexico, and Western Canada.

The next speaker was Dr. J. A. Amyot, Deputy Minister of

Health, Ottawa, who is an honorary member of the association. Dr. Amyot pointed out to the veterinarians the importance of their work in caring for the livestock of the country. His advice was that the veterinarian should educate the farmers up to an appreciation that they were now trying to make two-minute trotters out of hack horses; in other words, the average farmer is content with scrub stock when it costs no more either in time or money or labor to take care of the genuine article. Dr. Amyot also spoke on food values, dealing principally with milk.

Dr. Barnes, Chief Inspector, Meat and Canned Food Act, next gave an interesting address, referring to the inspection of meat and canned foods during the war.

Dr. Forsyth of the Municipal Health Department was then called upon for a song. He sang "Roaming in the Gloaming," and an encore "A Wee Doch and Doris," which were greatly appreciated.

The next speaker was Dr. C. D. McGilvray, principal of the Ontario Veterinary College, who gave an outline of the course now being given at the college.

Col. R. L. Mundhenk, of the Abbott Laboratories, was asked to say a few words. He appreciated the privilege of being at the meeting, and had pleasant memories of associations with wearers of the Maple Leaf in France during the late war.

An enjoyable evening came to a close about 11.30.

The morning session on Thursday commenced with a demonstration in the casting and restraint of horses, by Dr. D. R. Caley.

Dr. W. J. R. Fowler performed the radical operation for poll evil, and Dr. J. Porter performed a cryptorchidectomy. Both operators thoroughly explained their technique to the interested audience, and were assisted in their operations by Drs. McIntosh and Collett.

The meeting then adjourned to the lecture room, and Dr. J. B. Hollingsworth, Chief Food Inspector of Ottawa, presented a very interesting paper on "Better Dairy Cows."

The next paper was "Sterility in Cows," by Dr. J. N. Pringle of Toronto.

The afternoon session commenced at 2 o'clock and representatives of various biological houses addressed the meeting on the policy of their firms toward the veterinarian. Mr. I. S. Stinnel of the Mulford Company read a paper entitled "The

H. K. Mulford Company in the Veterinary Field," and Col. R. L. Mundhenk of the Abbott Laboratories also presented an interesting paper dealing with the idea of a tendency growing within us to make things in general more difficult and complex than they actually are. He referred principally to practice, pathology, and veterinary education. A hearty vote of thanks was extended to both these gentlemen for their excellent papers.

Representatives of the Parke Davis Company and the Lederle Laboratories also addressed the meeting, after which an illustrated lecture, "Standardization of Drugs," was given by Dr. A. R. Fader, of the Parke Davis Company.

Dr. A. Savage of Macdonald College, Quebec, an honorary member of the association, read an interesting and instructive paper on "Anesthesia in General Practice." Considerable discussion followed, dealing principally with the intravenous injection of chloral hydrate for narcosis, in which Dr. Savage has had great experience.

The last paper was read by Col. J. H. Wilson, of London. His subject was "Veterinary Ethics." Although short, the paper was excellent and full of good points.

The meeting was brought to a close by the sale of a number of the late Dr. R. A. Milne's books and instruments. Dr. Savage acted as auctioneer, and the sum of $101.35 was realized.

The next meeting will be held on the second Wednesday and Thursday in August. J. S. GLOVER, *Secretary.*

The social side of the life of the veterinarian finds expression in the organization of the Women's Auxiliary of the New York State Veterinary College, New York University, which was effected at a meeting held at the college Friday afternoon, April 1, 1921. Election of officers resulted as follows: Mrs. W. Horace Hoskins, wife of the Dean, President; Mrs. Roscoe R. Bell, Vice-President; Mrs. Wm. Herbert Lowe, Secretary, and Mrs. Robert S. MacKellar, Treasurer.

It was decided to meet monthly on the second Thursday of each month and a most cordial invitation is extended to all ladies of Greater New York and its environs who are interested to join in this movement for the promotion of the social activities of college life.

NECROLOGY

Dr. George Lauer Bushong died of cancer of the liver in Philadelphia, Pa., February 26, 1921, after a lingering illness of seven months. He was born in West Grove, Pa., July 12, 1882, and graduated at the Veterinary School, University of Pennsylvania, in 1912. He was an energetic, diligent student and worker. For several years past he was field agent for the Pennsylvania State Livestock Sanitary Board. He resigned this position last June and went to California, where his brother is practicing veterinary medicine. He was taken sick with liver trouble shortly after his arrival and was compelled to return to Philadelphia.

He was a member of the Pennsylvania State Veterinary Medical Association, the Philadelphia Veterinary Club, and the A. V. M. A.

His work was much appreciated by the State Bureau of Animal Industry and by the breeders and stockmen, with whom his duties brought him in contact. He had many friends who join his family in sorrow for his untimely death. He leaves a wife and three sons.

Dr. David W. Cochran, one of New York's best known practitioners, passed on early Easter morn, after many months of illness.

He was born in East 26th Street, New York City, in 1854 and was therefore 66 years old at time of death.

Graduating from the Columbia Veterinary College in 1879, from the American Veterinary College in 1880, he had practiced in that city for more than forty years.

He conducted one of the largest shoeing forges on the lower West Side at 19 Vesey Street, in connection with his practice, and had led a very busy life.

He was a member of the American Veterinary Medical Association, the New York State and New York County Veterinary Medical Societies, taking a very active interest in these organizations.

He was attached to the teaching staff of the New York State Veterinary College at New York University, covering the sub-

jects of shoeing and lameness. He was also Treasurer of his Alumni Association.

He was active and interested in Masonic circles, and the rites of these fraternal bodies were beautifully exemplified at the funeral ceremonies.

Mrs. Cochran and three daughters, Mrs. Luce, Mrs. Raymond and Mrs. Marsh, survive him.

A devoted wife and daughter mourn the death of Dr. John B. Jones, Atlantic City, N. J., which occurred March 18, 1821, following a brief illness from pneumonia. Dr. Jones was born at Allentown, Monmouth County, N. J., May 11, 1863. He was graduated from the New York College of Veterinary Surgeons, New York City, in 1897, whereupon he located at Atlantic City, and soon became one of New Jersey's most successful practioners.

Dr. Jones was a member of the Chamber of Commerce of Atlantic City; a former officer of the Veterinary Medical Association of New Jersey, and was also one of the founders of the New Jersey State Scholarship Fund in Veterinary Science established at New York University, New York City.

A large circle of friends mourn the loss of Dr. Alvin W. Schnell, Princeton, N. J., who died March 23, 1921.

Dr. Schnell was an alumus of the Veterinary Department of the University of Pennsylvania; a member of the Veterinary Medical Association of New Jersey, and one of the founders of the New Jersey Scholarship Fund in Veterinary Science established at New York University, New York City.

In the death of Dr. Peter A. Davison, Belmar, N. J., the profession of New Jersey sustains a distinct loss and New York University loses a most worthy son.

Dr. and Mrs. W. Horace Hoskins spent a short period in Philadelphia in March paying the last tribute of respect to Mrs. Cheever, the mother of Mrs. Hoskins. Mrs. Cheever passed into the Great Beyond at the age of 93 years. Her burial at West Chester, Pa., near the scenes of her childhood, and where most of her life had been spent, was in accord with her expressed wish.

MISCELLANEOUS

A NEW VETERINARY BUILDING FOR KANSAS

The Kansas legislature has made an appropriation of $100,000 for a new veterinary clinic building to be erected at the Kansas State Agricultural College. The building will be used exclusively for veterinary clinical purposes. The class rooms and laboratories of the Division of Veterinary Medicine in the Kansas State Agricultural College are at this time housed in a commodious three-story stone building perfectly adapted for veterinary instruction. With the addition of a new clinic building, the facilities at the Kansas State Agricultural College will be equal to that of any veterinary school in the United States. The fact that the Kansas legislature made such a large appropriation for hospital purposes indicates that they esteem very highly the value of veterinary services, especially since a large number of the legislators are engaged in livestock or agricultural pursuits.

HORSE ASSOCIATION LITERATURE

Veterinarians are becoming awake to the importance of getting more information with respect to farm motive power before the farmers in their respective communities. The Horse Association of America, through its indefatigable secretary, Wayne Dinsmore, Union Stock Yards, Chicago, Ill., has published recently three very interesting pamphlets on "Farm Power for Nothing," "Preparedness" and "Machine versus Muscle." These leaflets are available for distribution and Mr. Dinsmore will gladly furnish veterinarians throughout the country with copies in such quantity as they desire for distribution. Anyone who will take the time to read these articles will concede that they are particularly effective in bringing to the attention of farmers certain important problems in connection with motive power which they have as a rule failed to take into consideration.

SWEDEN'S SUCCESS

Foot and mouth disease is being fought strenuously but successfully in Sweden and thus far over 4,000 cattle, 2,000 pigs and 100 sheep have been slaughtered and the infected premises cleaned and disinfected.